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the glass industry

CONTENTS FOR JULY : 1954

A Method for Obtaining Glass Samples from a Continuous Glass Tank 365

A new sampling technique using translucent fused quartz tubing which enables the taking of samples from any location and depth in a continuous tank. By Edward L. Woodall, Jr.

Sensitizing—A Process Used in Silvering 367

A review of methods and materials used in sensitizing, the essential step before the silvering process. By Samuel Wein.

The German Export of Glass and Glassware in North, Central and South America 371

The German glassware industry continues to improve its position in export markets. By Erwin Stein.

New Glass Comparator 374

Describing a new device to compare relative color tones of pastel colored glasses. By Alexander Silverman.

Inventions and Inventors 377

A summary of recently issued patents of interest to the glass industry.

Research Digest 381

A summary of a paper, "The Dielectric Constant and Dissipation Factor of Soda-Potassia-Silica Glasses at Frequencies of 1 to 300 Kilocycles at Room Temperature".

Current Statistical Position of Glass 383

Production, shipments and employment in the glass industry during April and May 1954. Also, dollar values of shipments of pressed and blown glassware (except glass containers) for 1949 through 1953.

New Equipment and Supplies 384

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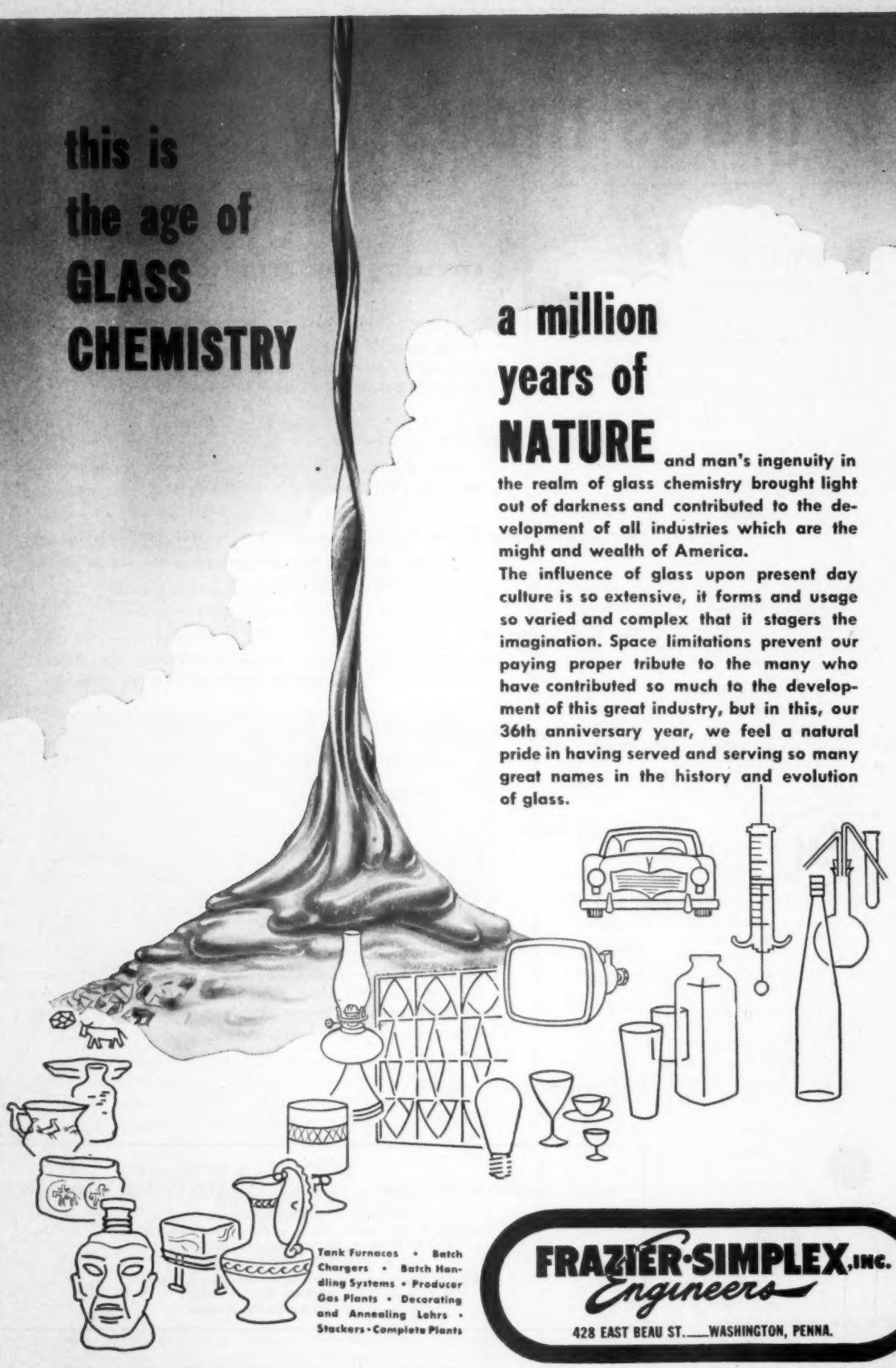
this is the age of GLASS CHEMISTRY

a million years of NATURE

and man's ingenuity in the realm of glass chemistry brought light out of darkness and contributed to the development of all industries which are the might and wealth of America.

The influence of glass upon present day culture is so extensive, it forms and usage so varied and complex that it stagers the imagination. Space limitations prevent our paying proper tribute to the many who have contributed so much to the development of this great industry, but in this, our 36th anniversary year, we feel a natural pride in having served and serving so many great names in the history and evolution of glass.



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THE GLASS INDUSTRY

VOLUME 35, NUMBER 7, JULY, 1954

A METHOD FOR OBTAINING GLASS SAMPLES FROM A CONTINUOUS GLASS TANK

By EDWARD L. WOODALL, JR.

Glass Technology Laboratory, Lamp Division of General Electric Co., Cleveland, Ohio

A knowledge of glass composition variations existing within a continuous glass tank is essential if glass quality is to be improved. Knowing the condition of the glass throughout the tank, it is much easier to locate sources of glass defects and to make changes, whether they be operational or in design, which will minimize or eliminate these defects.

Samples have been obtained in the past using a metal clamshell which is closed after being inserted into the glass. This method was unsatisfactory as large openings were required which restricted the locations from which samples could be obtained. The metal clamshell often would become jammed open after inserting it into the glass so a sample could not be obtained, and there was the possibility of contamination should the clamshell spall and flake off or be broken off inside the tank.

We have developed a new sampling technique using translucent fused quartz tubing which enables one to obtain glass samples from any location and glass depth in a continuous tank. By the use of this technique, we have been able to obtain much valuable information regarding our tank operations.

Procedure

The glass samples are obtained by inserting a 10′ to 14′ long, curved, translucent, fused quartz tube into the tank through openings in the superstructure sidewall. The openings may be a rake hole, a peephole block with the casting either in or out of place, or a 3″ hole that has been drilled through the refractory brick. After the tube has been inserted into the tank, the sampling end is slowly pushed into the glass until the straight length of the tube extending out of the tank is parallel with the bottom of the tank. Since the distance from the straight section of the tube to the curved sampling end opening is known, the depth from which the sample will be drawn can be determined.

A positive pressure is maintained inside the tube as it is being immersed into the glass to prevent, as much as possible, entry of glass into the tube. The pressure is furnished by a pressure-vacuum pump and supplied through a hydraulic hose to which is attached a one-hole stopper that has been fitted to the I. D. of the tubing.

As soon as the tube is in place, the hose connections to the pressure-vacuum pump are reversed, and a vacuum, about 24″ of Hg, is drawn inside the tube for 1 to 3 minutes, depending upon the viscosity of the glass and the amount of glass sample desired. It has been found that the tubes will not sag or bend while obtaining samples from refining ends operating at 1325°C. or less but will start to sag or bend if exposed at 1350°C. or higher for more than 2 minutes. However, at the higher temperatures, only 1 to 1.5 minutes of applied vacuum is needed to obtain a large sample, and the tubing does not bend during this time.

The vacuum is released as soon as the desired amount of glass has been drawn into the tube, and the tube is then quickly withdrawn from the tank. Next, a positive pressure is applied inside the tube, and the molten glass is forced from the tube into an iron mold. The sample of glass is wrapped in asbestos paper as soon as it sets and allowed to slowly cool to room temperature. Should the tube break after it is removed from the tank or the glass cannot be blown from the tube, the filled section of the tube can be wrapped in asbestos paper and slowly cooled to room temperature. On cooling, the tube will break away from the inside glass, usually leaving the sample in the shape of a slug.

Presented before the Fourteenth Conference on Glass Problems, University of Illinois, Urbana, Illinois.

The cooled samples are then tested for physical properties and chemical composition.

Forming Sampling Tubes

The 2″ maximum O. D., 7/8″ minimum I. D., translucent fused quartz tubing used to obtain the samples can be purchased for $1.50 per foot from the General Electric Cleveland Quartz Works in straight sections ranging from 10′ to 14′ in length. These tubes are bent in a gas-fired furnace, constructed of K-23 insulating brick, operating at 1325°C.-1350°C. Two high-pressure inspirator burners, one mounted at each end of the furnace, supply heat. A series of steps project in 4″ from one sidewall of the furnace, outlining the contour of the arc to which the tube will be bent. The height of the furnace and the radius of the arc is set by the maximum depth from which the glass sample is to be taken and the clearance in and around the tank. The front of the furnace should be constructed so the top four or five rows of brick can be removed to facilitate the removal of the bent tubes from the furnace.

The straight tubes are inserted into the hot furnace and positioned so that they will touch the projections in the sidewall as they bend. For a maximum bend, the tubes are inserted into the furnace as far as possible. This distance is reduced to obtain a smaller bend in the tubes. The time required to obtain the desired bend in the tubing varies from 5 to 30 minutes, depending on the wall weight and I. D. of the tubing, the temperature of the furnace, and the distance the tube is inserted into the furnace.

Advantages and Disadvantages

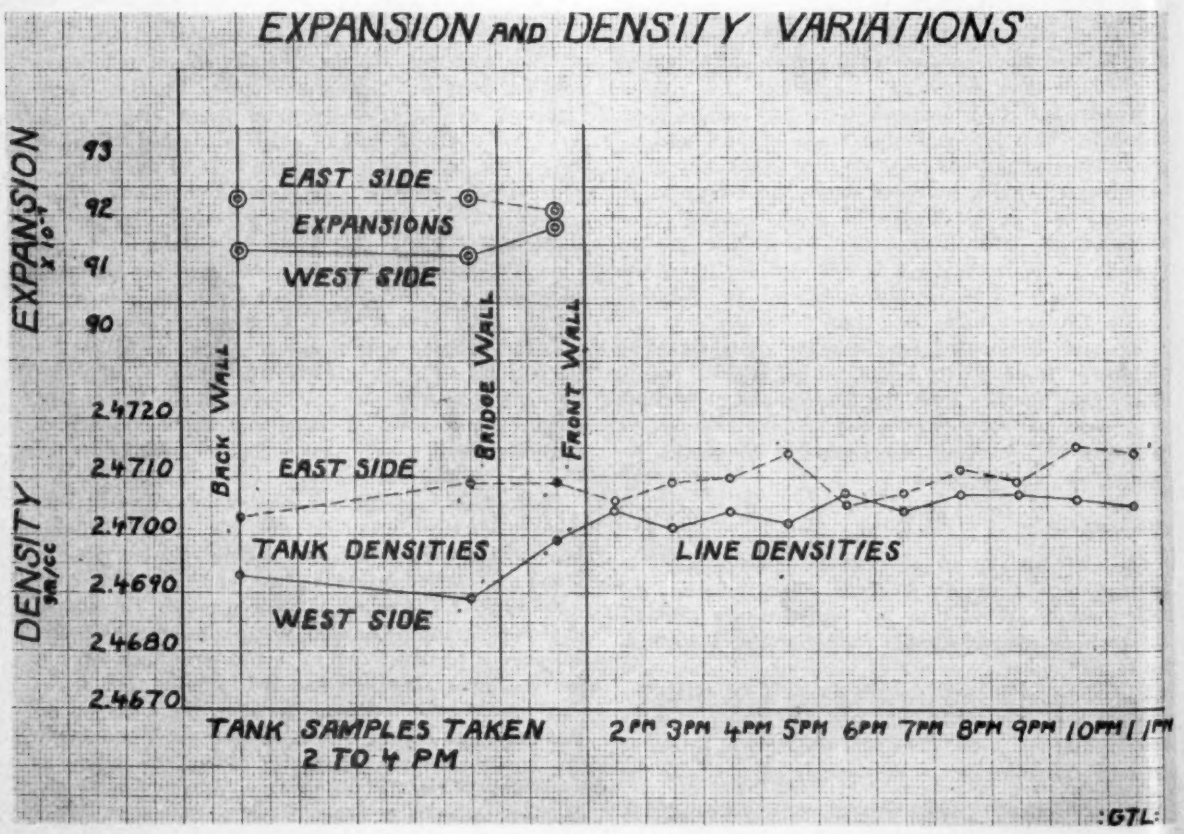
There are several advantages offered by this technique; namely, (1) samples can be quickly obtained from any location in the tank, (2) the sampling can be done through small openings, (3) there is no possible contamination of the melt should the sampling tube be broken off inside the bank, (4) the sample is not contaminated by the sampling tube. One disadvantage is the high cost of the quartz when compared with other mechanical means of obtaining samples. However, the cost of the tubing compared to the information obtained and the total cost of sampling is small.

The samples are taken through rake hole openings in the refining end and peephole openings in the melting end and forehearths. The openings into the refining end are 9″ x 9″, while the peephole openings are 3″ in diameter, if the casting is removed, and 2¼″ in diameter if the casting is left in place.

In cases where samples are needed from the center of a large tank or from the melting end of a side port tank, 3″ holes may be drilled through the crown, and samples drawn up into straight tubes inserted through these openings. A hoist or pully arrangement is necessary when obtaining samples through the crown as the tube must be pulled straight up, and it is too hot and heavy for the operator to handle with tongs.

Samples have been taken across a side port tank on a line between the second and third ports by going through the crown. The samples were taken six weeks before the tank was drained for repairs. At the time of the tank repair, it was found that the silica brick around the

(*Continued on page* 394)



SENSITIZING—A PROCESS USED IN SILVERING

By SAMUEL WEIN

Introduction

The most important step in silvering any surface, whether glass, ceramic, plastic, wax, etc., immediately after the cleaning process is that step which is known as "sensitizing". It cannot be too strongly emphasized that the omission of this step in the process may lead to complete failure to obtain a good silver film on the given surface. This step brings about (1) increased adhesion of the subsequently deposited silver, (2) reduces the time of formation and (3) gives rise to a more uniform film throughout the entire surface.

"Sensitizing" is the common term used for this process. However, some workers prefer to use the expression "priming" the surface; in other words, irrespective of terminology, the given surface is made ready for the subsequent formation of the silver film.

In the common or accepted process, a diluted solution of tin chloride (if that be the sensitizing compound used) in water is poured or otherwise applied to the given surface and subsequently washed off with running water.

Extensive work on the subject was done by Kohlschutter and Fischman, vonWartenberg, Neiman and Moskvin and others. They all concluded that the surface adjacent to the glass consists of colloidal silver and is amorphous in nature. Kohlschutter discusses this subject from an academic viewpoint.

Sensitizing glass, ceramics, plastics, wax and other surfaces are intended primarily for two purposes, and these are: (1) The formation of mirrors, reflectors and the like. (2) The formation of a silver film serving as an electrically conducting film on which other metals may be electrolytically deposited.

Theories for Sensitizing

Fafet assumed that a molecular film of tin silicate was formed on the glass surface, but this does not explain the equal effectiveness of tin chloride treatment of surfaces other than glass. Take the specific case of plastics, wax, etc., where no silica is involved. Wall assumes that tin chloride functions as a degreasing agent, but this does not explain the good effects of tin chloride with surfaces already freed from grease by chemical means.

Hepburn stated that "it seems more reasonable to suppose that the true function of the sensitizing agent is to initiate the deposition of the silver particles through initial reduction by the absorbed layer of the sensitizing agent and to increase adhesion through the absorption forces operating at the surface".

Banks and Upton found that the use of tin salts gave rise to the deposition of a basic film of a basic stannous compound, i. e., hydroxide or basic chloride, on the surface and further that a hydrophilic film having appropriate reducing properties could be produced on a hydrophobic surface by immersion for a few seconds in a stannous chloride solution containing anionic detergent.

Chemistry of Tin Chloride

Tin chloride, tin bichloride, tin protochloride, stannous chloride and "tin salts" are all commonly used names in the mirror industry. Its chemical symbol is $SnCl_2$ or $SnCl_2 + 2H_2O$. It is available as a white crystal, the specific gravity is 2.71, melts at 246°C. and the boiling point is between 303-628°C. when it decomposes. It is readily soluble in water, alcohol tartaric acid and in alkalies. Commercially, it is available as technical and C. P., as well as in 50% aqueous solution.

An anhydrous form of tin chloride may be had which is sold under the trade name of "Stanno-chlor" and has greater stability and greater concentration (25%).

The Tin Research Institute, Inc. serves as a source of information with bulletins on the chemistry of tin, and it is a free service. The Malayan Tin Bureau likewise offers free distribution of technical bulletins dealing with tin.

Early History. Cimeg in the winter of 1861 was granted a British Patent on the use of Rochelle salts with silver nitrate as a sensitizer. The Process he suggested was one in which the glass was given a preliminary treatment with a solution made up of

Rochelle salts	1 part
Water	200 parts

Subsequently the surface was treated with a solution made of

Rochelle salts	14 grams
Silver nitrate	20 grams
Water to make	60 grams

and sufficient ammonia is added to redissolve the precipitate first formed.

The foregoing disclosure then is the forerunner of all processes for sensitizing glass and other surfaces prior to the precipitation of metals such as silver, etc.

The first mention in the use of tin chloride for the treatment of glass surfaces is accredited to Pratt who in 1876 suggested

Tin chloride	1 part
Water	100 parts

An alternative compound consisted of

Tin chloride	1 ounce
Ammonium oxalate	5 drams
Putty powder	½ pound

This is applied to the surface by means of a soft rubber, allowed to dry, then washed with running water.

Namias in 1897 and Fafet in 1898 used solutions of the chloride as low as 0.01% and found them adequate to produce films of silver from 3 to 5 times more rapidly than with an unprepared (non-sensitized) surface.

Fafet found that the convenience, as well as the character, of the silver mirror depends on the manner of preparing the glass surface. To this end, he washes the surface clean, treats it with a solution of tin chloride, subsequently washes it with running water. This is the common or accepted technique used today. Such treatment will permit ease of film formation. As little as 0.01% tin chloride solution was found adequate to produce silver films from 3 to 5 times more rapidly than with an unprepared surface. Namias verifies this finding.

In a paper read before the 5th International Congress of Applied Chemistry in 1903, Dr. Toch described the then current silvering practice in the United States. The preparation of the glass with tin chloride, as well as tin oxide, in the form of a putty figured prominently in the practice.

Methods of Application. There are four techniques used in applying the sensitizing solution to the given surface.

(1) Soaking is about the simplest of these. For instance, the glass or other pieces to be sensitized are steeped into the solution. If the pieces are small, they may be placed in a suitable receptacle, glass crock or stainless wire basket, and this in turn is steeped into the solution.

(2) The solution is poured onto the given surface from a convenient receptacle, such as a pitcher, etc.

(3) A felt block is steeped into the solution and it in turn is rubbed over the flat surface. If felt blocks are not available, a sponge (natural or synthetic) may be used instead. It must be borne in mind that once the felt block or sponge has been used with the sensitizing solution, it must never be used for any other step in the process. It is well, after the sensitizing process is carried out by this technique, to wash the felt block or sponge with running water.

(4) The sensitizing solution may be applied as by means of compressed air through the medium of a "gun" such as is the case with spraying lacquers and paints.

Simple Solutions. The proportions of tin chloride in water may vary from 0.5 per cent up to 10 per cent in water. Greater percentages in concentration serves no useful purpose, and should be avoided.

If scales are not available to measure (weigh) out the tin compounds and since the exact weight is unimportant in this case, about the simplest way out of measuring the required quantity is to take a quarter of a teaspoonful of the compound and to dissolve it in a quart of water to make a workable solution.

Experience has taught us that if the solution is too strong, it will give rise to streaks on the silver side of the mirror. On the other hand, it might indicate that the tin salts have not been adequately washed off.

Macchia suggested a 20-second treatment with

Tin chloride	1 part
Water	1000 parts

The author has found the following solution satisfactory:

Tin chloride	20 grams
Water	1 gallon

It is wise to make up a fresh solution daily in order to avoid difficulties from stale solution.

Hepburn refers to the use of a 5 to 10 per cent solution of tin chloride for use with phenol-aldehyde surfaces.

Morgan and Myers used 0.5 gram of tin chloride per 1000 c.c. of distilled water. An excess of the sensitizer is applied by use of a rubber sponge to the clean surface. It is then rubbed in evenly over the surface. Then, by means of a soft bristle brush, the sensitized surface is scrubbed with a good supply of distilled water. It is usually noticed that once the unwanted excess of tin chloride is removed, the brush does not glide over the glass as easily as it did at the beginning. Finally, the surface is rinsed with the distilled water and then silvered without allowing the surface to dry in spots before application of the silvering solution.

Owen recommends 0.25 ounces of tin chloride to the gallon of water, or 2 grams per liter of water. The sensitizing solution is made fresh every day.

The Surf Chemical Corp., manufacturers of silvering compounds, suggests the following technique for making stock sensitizing solutions for one day's supply. The actual tinning solution is made by adding stock solution to distilled water just before each tinning operation.

Make up a one-day supply of tinning solution at the quantity of 5 gallons per 100 square feet of mirror surface. The stock solution and the actual tinning solution is made up in advance according to the following table:

No. 1 Sq. Ft. Per Day	No. 2 Ozs. SnCl	No. 3 Add dist. water to make	No. 4 Quantity of stock solut. Ounces	No. 5 Add dist. water to make	No. 6 Tin solut. Gallons
100	1		10		5
200	2		20		10
300	3		30		15
500	5		50		25

Determine the square feet of mirrors to be made per day. Add the tin chloride in the quantity from column 2 to the distilled water to make the quantity of stock solution to each gallon of water (distilled used in tinning, see columns 5 and 6).

Pour tinning solution, as made from column 6, on the glass surface and starting at the top edge, scrub the glass with the tinning solution across the back in overlapping rows until the glass has been scrubbed with the tin once. Then repeat this process starting at the right side of the glass if right-handed and at left side if left-handed. Scrub up and down in overlapping rows. Use a viscose sponge, felt block or scrub brush softened with a fresh tin solution or distilled water before use. Use only one side of the sponge or felt block. After tinning, rinse with distilled water, about 1 gallon per 20 square feet of mirror surface.

Acid Solution. Mellor has shown that the addition of hydrochloric acid to the tin chloride solution will "clear" and prevent considerably the hydrolysis of the solution.

Whyte used an acid tin solution on wax phonograph recording surfaces. The solution composition was:

Tin chloride	5-10 grams
Hydrochloric acid	50 c.c.
Water	1000 c.c.

Before treating the wax surface with the above acid tin solution, it was first given a rinse with a diluted solution of alcohol and water in order to reduce the surface tension. After treatment with the above acid tin bath, it was washed with running water.

Walker recommended the following tin-acid bath for use with plastic surfaces:

Tin chloride	360 grams
Hydrochloric acid	216 c.c.
Water	4000 c.c.

This solution is stated to be of a "milk-like consistency". It is employed in the Metalplast process of plastic plating.

Owen recommends:

Water	1 liter
Tin chloride	10 grams
Hydrochloric acid	16 c.c.

Dr. Myers suggested the following formulation in connection with his coppering process:

Tin chloride	180 grams
Hydrochloric acid	180 c.c.
Water	200 c.c.

The length of time of treatment with this solution was between 1 and 2 minutes, and the acid tin solution was rinsed off the treated surface.

Gallo, a manufacturer of silvering compounds, suggests the use of:

Tin chloride	1 ounce
Water	1 gallon
Hydrochloric acid	10 c.c.

Banks and Upton's version consists of:

Tin chloride	0.2 molar
Hydrochloric acid	1.0 molar

to which has been added 1% by weight of a wetting agent, such as alkylated naphthalene sulphonate.

Wein uses citric acid in the place of hydrochloric acid in the following formulation:

Tin chloride	10 grams
Citric acid	10 grams
Water	1 gallon

Low adds an organic acid (glacial acetic acid) to the foregoing tin chloride-hydrochloric acid solution. His formulation consists of:

Tin chloride	23 grams
Hydrochloric acid	12 c.c.
Acetic acid (glacial)	25 c.c.
Water to make	2000 c.c.

The tin chloride is dissolved in about 500 c.c of water to which hydrochloric acid has been added. The acetic acid is then added and the solution made up to 2000 c.c. This solution does not keep well as tin oxychloride tends to be formed. It should, therefore, be made as frequently as may be convenient. As soon as the article (glass) has been treated (sprayed) with this solution, it is to be immediately sprayed with distilled water to wash off the last trace of the tin compound, and then, as quickly as possible, it is to be silvered.

Alcoholic Solution. Alcoholic solutions of tin chloride have been found to be advantageous in that they tend to reduce "surface tension" and to "cut" (dissolve or clean) surfaces from grease, etc., that might be found on the product to be silvered.

Kiefer recommends the addition of alcohol, but gives no details for its use.

Marriage suggests the following solution:

Tin chloride	2.2 grams
Sodium hydroxide	2.0 grams
Water	20 c.c.
Alcohol	30 c.c.

Dr. Kantrowitz, with his associates, recommends the following tin-alcohol solution:

Tin chloride	15 grams
Isopropyl alcohol	1 quart

Since this solution does not keep well (24 hours), it is advisable that only a small quantity be prepared each time, sufficient to warrant the required amount. The surface is then swabbed with the solution, and subsequently washed with running water. Other alcohols are mentioned by Kantrowitz, etc., such as ethanol, methanol and normal propanol, and similar aliphatic alcohols can be employed. These solutions were intended for sensitizing Vinylite (Vinyl acetate-Vinyl chloride polymer) sheets such as used in the electrotyping industry

The surface to be silvered is first treated with a solution of calcium carbonate in EtOH and ammonia.

Other Tin Salts. Schreiber makes use of an aqueous tin sulphate solution at 5° Be′ for less than 5 minutes, then rinses the treated surface with water.

Solutions of sodium stannate have been mentioned in the literature. These are formed by adding an excess of sodium hydroxite to a solution of stannous chloride, precipitating a heavy white mass (tin hydroxide), but this latter is redissolved as more sodium hydroxide is added to the solution.

Tin Fluoborate. Also termed stannous fluoborate, $Sn(BF_4)_2$, with a molecular weight of 292.3, it is available as a colorless solution. Dr. Marcus steeps the plastic pieces for time periods up to 1 minute in a solution of:

Tin fluoborate	15-20 grams
Fluoboric acid, 42%	250 c.c.
Sodium chloride	75-100 grams
Water	1000 c.c.

The chemical method of preparing tin fluoborate is disclosed by Ferguson.

Addition Agents. There are two sets of investigators who have added: (1) *Metals:* Owen placed a piece of metallic tin in the tin chloride solution to prevent some of the tin chloride from being oxidized to the stannic state, in which case it would lose effectiveness as a sensitizing agent. (2) *Wetting and Swelling Agents:* St. Gobain adds swelling agents to the tin salts. Weiss recommends the following sensitizer:

Water	800 c.c.
Ethyl alcohol	250 c.c.
Sulphuric acid	5 c.c.
Quinol	10 grams
Tin chloride	30 grams

The plastic pieces are treated with this solution for 45 minutes, and subsequently washed with running water. This is the basis used by Cohan-Epner Co. of New York for plating plastics.

Pessel recommends a 0.3 per cent tin chloride solution containing 2 per cent of a wetting agent for use with piezo crystals to be metallized.

Upton, Soundy and Busby use approximately 4.8% tin chloride in 3.5% hydrochloric acid (just sufficient to prevent hydrolysis of the stannous chloride solution) and containing 1% of "Perminal WA" or "Perminal BX". Perminal compound is a commercial product made in England. Chemically it is sodium alkyl naphthalene sul-

phonate, type "WA" being standardized with an inert diluent. The solution was prepared by dissolving 120 grams tin chloride in 100 ml. of concentrated hydrochloric acid, warming if necessary to obtain a clear solution, diluting to 2¼ liters and adding 250 ml. of 4R Perminal BX solution.

Dimethyl Tindichloride. The chemical formula is $(CH_3)_2SnCl_2$, is patented by Martinson and Sun for treating various plastic surfaces and made polar in nature merely by subjecting it to the fuming vapors of this compound, and subsequently permitting it to hydrolyze for a few minutes at the atmosphere of the room.

Miscellaneous Sensitizers

The technical and patent literature from time to time record the use of inorganic and organic compounds as sensitizers for glass, plastics and other surfaces, with varying success. Herewith follows in alphabetical order the compounds mentioned in the literature.

Aluminum Chloride. The chemical formula is $AlCl_3$. Its use was suggested by Neiman and Moskvin, and subsequently referred to by Banks and Upton in their patent specification. None of these investigators mention its proper formulation. The present author has actually tried a 10% aqueous solution for use with glass surfaces, and the results were fair as compared with tin chloride solutions. However, one thing may be said in its favor, i.e., the solutions remained clear for a long time as compared with tin chloride which hydrolyzed in a short while, making the solution unfit for use in a few hours.

Chromium Compounds. Banks and Upton refer to the use of chromium compounds but overlook mentioning which one, and give no indication as to its possible use.

Germanium Dimethyl Dichloride. This compound was suggested by Martinson and Sun for the treatment of cellulose acetate butyrate sheets.

Iron Compounds. The iron salts are mentioned in the patents by Banks and Upton, but no details are given for the specific iron compound or the given quantity. Hepburn suggests the use of a 2½ per cent solution of ferrous sulphate as a sensitizer.

Hydroquinone. Hepburn mentions the use of this compound (2½ per cent solution) as a sensitizer.

Lead Acetate. Smith used a 0.1% freshly prepared solution of this compound, claiming that a "more brilliant bluish white mirror was formed" because of its use. This solution may be acid or alkaline. Neiman and Moskvin verify the use of lead acetate as a sensitizer.

Methylene Blue. This is an organic (synthetic) dye, is suggested in 0.5% solution concentration by von Wartenberg, as well as by Neiman and Moskvin.

Palladium Chloride. The formula is $PdCl_2+2H_2O$. It is a dark brown deliquescent powder, soluble in water and hydrochloric acid. Narcus in his coppering process suggested the following composition as a sensitizer:

Palladium chloride	½ to 1 gram
Hydrochloric acid	10-15 c.c.
Water	1000 c.c.

Pyrogallol. Hepburn suggests the use of a 2½ per cent solution of this compound.

Silicon Compounds. Geiser and Matimoe treated nonwettable plastics, such as polystyrene, the methacrylates, vinyl chloride acetate copolymer and ethyl cellulose, with the vapors of silicon tetrachloride. The surface of the plastic apparently formed a film of amorphous SiO_2. The treatment was given to glass and plastic at 50° to 80°C. for only a few seconds. After the foregoing treatment, it is washed with running water. von Wartenberg found that the treatment with a 2% silicon chloride solution gave satisfactory results. Dimethyl silicondichloride $(CH_3)_2SiCl_2$ was recommended by Martinson and Sun for treatment of cellulose acetate. The vapors were condensed on the surface and then allowed to hydrolyze.

The following series of chlorinated silane compounds may have possibilities as sensitizing agents. These compounds are Amyltrichlorosilane, $C_5H_{11}SiCl_3$, a colorless liquid, molecular weight 205.57, soluble in most organic compounds; Diethyldichlorosilane, $(C_2H_5)_2SiCl_2$, a colorless liquid, molecular weight of 157.10, soluble in most organic compounds; Ethyltrichlorosilane, $C_2H_5SiCl_3$, a colorless liquid, molecular weight 163.51, soluble in most organic compounds; Phenyltrichlorosilane, $C_2H_5SiCl_3$, a colorless liquid, molecular weight 211.54, soluble in most organic liquids; Vinyltrichlorosilane, $CH_2=CHSiCl_3$, a colorless liquid, molecular weight of 161.48, soluble in most organic liquids.

Thorium Nitrate. The chemical formula is $Th(NO_2)$ This is a white crystalline mass, decomposes on heating, soluble in water and alcohol. There are two grades commercially available, technical and C. P. vonWartenberg recommends treatments with a 0.1% solution of thorium nitrate or oxide. Smith found that a more brilliant bluish white film was formed when these reagents were used than is the case with other types of sensitizers. Neiman and Moskvin also describe the use of these sensitizers.

Titanium Compounds. vonWartenberg suggested a 0.1% aqueous solution of titanium dioxide (TiO_2). Neiman and Moskvin found that titanium chloride solutions are better to use. Pfidal found titanium sulphate a practical and satisfactory compound to replace tin salts. He recommended 0.04 to 0.06 per cent solutions. Titanium tetrachloride as a sensitizer is patented by Gaiser and Matimoe, and referred to by Martinson and Sun. Narcus used titanium oxide in the presence of a wetting agent (sodium lauryl sulphonate) for use in his coppering process. His preferred solution consists of:

Titanium oxide	5-10 grams
Sulphuric acid	40-50 c.c.
Wetting agent	0.5%
Water	

A simpler solution used by Narcus is made up of:

Titanium chloride (conc. solut.)	50 c.c.
Hydrochloric acid	50 c.c.
Water	1000 c.c.

When initially made, this solution will be violet in color, but after use, it changes to a green color. When this color change occurs, the solution loses its effectiveness as a sensitizing agent and must be discarded.

Diemthyl titaniumdichloride is patented by Martinson and Sun.

(*Continued on page* 392)

THE GERMAN EXPORT OF GLASS AND GLASSWARE IN NORTH, CENTRAL AND SOUTH AMERICA

By ERWIN STEIN

According to the official figures of the Federal Office of Statistics, the export of glass and glassware has further gone up in 1953. After an increase of over $2 million in 1952, a further increase of over $5 million was attained, nearly $2 million of which are apportioned to raw glass and over $3 million to glassware.

The total export in 1953 was about $35½ million. These developments are summarized in Table 1. The export figures are broken down according to the different classifications for the years 1953 and 1952, and are shown in Table 2. Increases appear in almost all, decreases in only a few positions. In many classifications of unfinished glass, the U.S.A. is the most important customer, sometimes buying in the millions of dollars. Of the total export figure, the U.S.A. purchased 23% of unfinished sheet glass; 38% of plate glass, cut or polished; 46% of flat glass; 48% of optical glass. In several cases, Canada rates as customer Number 2 (e.g., unfinished sheet glass, 8%). Colombia, Peru, Venezuela, Argentina have been customers for more than $100,000.

In the group of glassware (finished goods), the U.S.A. was the most important customer with value of one million dollars and more. The most important export values to the U.S.A. of nearly $5 million were: glass petty goods, glass animal eyes and other products of that kind, which equalled 66% of the total figure. The U.S.A. also bought 30% of finished domestic glassware, 20% of lighting and signal glass, 45% of optical glass and glass for spectacles, but only 7% of unfinished domestic goods; 6% for glassware for laboratories and 9% for other glassware were exported to the U.S.A. Argentina purchased 10% of glass in rods in glass balls, etc., and 23% of glass pistons and tubes for electronics. Canada bought 6-7% of safety glass. In other classifications, Canada maintained the second place. The exact quantities and values exported to countries in North, Central and South America are shown in Table 3 for all classifications.

A far better picture is obtained in the summary breakdown according to countries. This table shows,

TABLE 1

Export	Year	Tons	Dollars
Glass	1953	48,800	9,121,428
	1952	34,300	7,254,761
Glassware	1953	55,600	26,516,666
	1952	51,900	22,835,714
TOTALS	1953	.....	35,638,095
	1952	.....	30,090,476

TABLE 2

Export	Year	Tons	Dollars
Glass rods, balls, etc...	1953	1,926	859,523
	1952	1,556	741,190
Of this total, export to:			
Argentina	....	153	90,476
Venezuela	....	18	8,571
Cast glass, unfinished..	1953	10,372	1,191,666
	1952	9,198	977,142
Of this total, export to:			
U.S.A.	....	171	20,714
Brazil	....	71	11,428
Colombia	....	74	16,190
Sheet glass, unfinished.	1953	30,458	3,939,761
	1952	19,461	2,646,904
Of this total, export to:			
U.S.A.	....	7,118	903,095
Canada	....	2,741	308,333
Cuba	....	296	50,476
Dominic. Rep. ...	....	185	33,095
Colombia	....	1,057	134,285
Peru	....	835	109,761
Venezuela	....	706	107,619
Plate glass, cut or polished	1953	5,872	1,679,523
	1952	5,039	1,294,785
Of this total, export to:			
U.S.A.	....	2,411	600,238
Canada	....	278	75,952
Cuba	....	164	71,190
Argentina	....	481	121,428
Brazil	....	70	23,333
Flat glass (sheet glass), finished	1953	299	465,238
	1952	128	244,761
Of this total, export to:			
U.S.A.	....	40	215,238
Canada	....	3	24,285
Safety glass	1953	653	432,142
	1952	248	182,619
Of this total, export to:			
Canada	....	65	27,380
Peru	....	52	20,952
Colombia	....	38	19,485
Glass pistons and tubes for electrotechnical purposes	1953	948	480,000
	1952	1,033	632,142
Of this total, export to:			
Argentina	....	189	108,809
Glass for optical purposes, optical not treated	1953	175	1,020,238
	1952	234	1,235,238
Of this total, export to:			
U.S.A.	....	22	488,809
Argentina	....	11	37,619

too, where increases or decreases given in Table 4 have taken place since 1952. First of all, export values have gone up since 1952 by more than $3 million to the U.S.A., by $1.4 million to Canada, and $600,000 to Argentina. This means a participation in the German glass export of 22% for the U.S.A., 5% for Canada and 3.5% for Argentina. All other countries participate only with shares of under one-quarter million dollars in spite of important augmentation of their absolute trade turnover. Referring to Brazil, the German deliveries decreased by more than 1.3 million, resulting in a share of only 15% of the figure of the year before. Also, the figure of Uruguay has gone down.

German deliveries to the U.S.A. in the group of glass products show a far higher figure than for the group of glass, having gone up by $400,000 since 1952. The deliveries to Canada have increased by about $75,000, to Venezuela by about $200,000, and to Columbia by over $100,000. The share in the total export is nearly 30% for the U.S.A; Canada, Venezuela and Colombia share by 1 to 2% each. Turnover increases of more than $20,000 are shown in connection for Cuba, Dominic-Republic, El Salvador, Bermuda, Bahamas and Jamaica, Chile, Equador and Peru. Diminuation of turnover is to be observed in the cases of Bolivia, Brazil, Paraguay and Uruguay, and more so for Argentina and Mexico (by about $150,000 each and down to only 44% of the export value of 1952). These data are summarized in Table 5.

It is interesting to compare these figures with those of

TABLE 3

Export	Year	Tons	Dollars
Bottles, glass preserve jars, unfinished	1953	42,563	4,004,047
	1952	40,825	3,697,142
Of this total, export to:			
U.S.A.	....	130	20,952
Dominic. Rep. ...	....	220	28,333
Bermuda, Bahamas, Jamaica	....	392	44,761
Venezuela	....	580	110,476
Glassware for the household, not treated (domestic purposes) ...	1953	5,422	1,476,666
	1952	4,279	1,316,666
Of this total, export to:			
U.S.A.	....	72	102,380
Canada	....	146	75,476
Mexico	....	7	13,571
Venezuela	....	14	16,904
Colombia	....	10	13,809
Glassware, for domestic purposes, finished ..	1953	2,388	4,314,761
	1952	1,636	3,598,571
Of this total, export to:			
U.S.A.	....	541	1,288,333
Canada	....	127	197,857
Cuba	....	5	17,857
Guatemala	....	6	15,000
Mexico	....	43	149,047
Argentina	....	6	22,142
Brazil	....	18	44,047
Chile	....	4	15,952
Colombia	....	22	81,190
Peru	....	6	17,857
Venezuela	....	46	139,523
Illumination glass, signal glass	1953	1,235	1,253,809
	1952	1,019	1,013,333
Of this total, export to:			
U.S.A.	....	92	252,380
Canada	....	12	15,714
Bermuda, Bahamas, Jamaica	....	16	14,285
Hollow glass for watches and for ordinary spectacles	1953	57	204,761
	1952	40	158,571
Of this total, export to:			
Argentina	....	10	43,571
Brazil	....	2	18,333
Glassware and laboratories, hygienic and pharmaceutical purposes	1952	685	1,894,237
	1952	712	1,827,857
Of this total, export to:			
U.S.A.	....	17	117,619
Mexico	....	17	42,619
Brazil	....	13	46,428
Colombia	....	15	33,571
Peru	....	25	41,904
Uruguay	....	7	20,952
Venezuela	....	13	31,428
Optical glass, including glasses for spectacles	1953	175	1,020,238
	1952	234	1,235,238
Of this total, export to:			
U.S.A.	....	22	488,809
Argentina	....	11	37,619
Glass petty goods, glass eyes for animals..	1953	1,398	7,226,190
	1952	234	7,213,809
Of this total, export to:			
U.S.A.	....	811	4,782,142
Canada	....	30	167,380
Cuba	....	4	43,333
Guatamela	....	4	15,238
Mexico	....	4	29,285
Peru	....	3	18,809
Venezuela	....	4	23,095
Other glassware, glass lamps	1953	233	368,571
	1952	157	258,333
Of this total, export to:			
U.S.A.	....	19	34,047

pre-wartime. It can be stated that the German deliveries to the U.S.A. in 1953 in glass were 650 tons, or 57%; and in glass products 2800 tons, or 550% higher than the total export quantities of the former Reich to the United States.

TABLE 4

Export of the Federal Republic

Glass	Year	Tons	Dollars
U.S.A.	1953	9,785	2,051,904
	1952	3,070	1,318,095
Canada	1953	3,156	448,095
	1952	841	115,714
Costa Rica	1953	63	8,333
	1952	169	19,047
Cuba	1953	469	124,523
	1952	192	50,000
Dominic. Rep.	1953	187	34,523
	1952	110	20,713
Guatemala	1953	61	11,190
	1952	25	3,809
Haiti	1953	83	10,713
	1952	24	3,095
Republic of Honduras.	1953	14	3,333
	1952	9	2,619
Mexico	1953	12	15,000
	1952	2	2,619
Nicaragua	1953	22	3,333
	1952	24	3,571
Republic of Panama..	1953	30	7,857
	1952	5	1,190
El Salvador	1953	114	20,000
	1952	103	14,761
Bermuda, Bahamas, Jamaica	1953	43	4,285
	1952	50	7,142
Netherlands Antilles ..	1953	5	3,095
	1952	3	1,666
Argentina	1953	733	323,333
	1952	305	179,523
Bolivia	1953	48	8,571
	1952	98	16,904
Brazil	1953	156	56,666
	1952	1,439	424,285
Chile	1953	44	13,571
	1952	18	3,333
Colombia	1953	1,182	180,238
	1952	906	143,571
Ecuador	1953	172	16,904
	1952	147	143,571
Peru	1953	975	146,428
	1952	399	52,142
Uruguay	1953	158	28,095
	1952	626	84,047
Venezuela	1953	820	142,142
	1952	770	129,047

TABLE 5

Export of the Federal Republic

Glassware	Year	Tons	Dollars
U.S.A.	1953	1,977	7,845,238
	1952	1,546	7,541,428
Canada	1953	3,156	448,095
	1952	210	367,142
Costa Rica	1953	163	47,380
	1952	17	25,714
Cuba	1953	59	187,857
	1952	41	139,761
Dominic. Rep.	1953	230	50,952
	1952	6	12,857
Guatemala	1953	27	60,476
	1952	27	51,904
Haiti	1953	83	10,713
	1952	17	17,619
Honduras	1953	68	24,285
	1952	5	13,095
Mexico	1953	102	122,142
	1952	85	275,714
Nicaragua	1953	86	27,619
	1952	33	14,523
Republic of Panama..	1953	99	29,285
	1952	6	14,523
El Salvador	1953	32	52,619
	1952	18	26,428
Bermuda, Bahamas, Jamaica	1953	498	135,476
	1952	152	57,619
Netherlands Antilles ..	1953	6	14,047
	1952	4	11,428
Puerto Rico	1953	2	6,904
	1952	1	4,285
Argentina	1953	11	41,904
	1952	93	201,666
Bolivia	1953	15	33,333
	1952	20	49,047
Brazil	1953	49	154,761
	1952	60	182,857
Chile	1953	16	99,761
	1952	26	45,952
Colombia	1953	134	293,809
	1952	71	159,285
Ecuador	1953	80	76,666
	1952	41	48,809
Paraguay	1953	28	36,428
	1952	348	67,619
Peru	1953	73	187,619
	1952	62	134,047
Uruguay	1953	18	60,238
	1952	62	98,333
Venezuela	1953	685	429,523
	1952	128	234,047

• The Corning Museum of Glass is presenting the second in a series of special exhibitions devoted to the history of American Glass: American Pressed Glass of the Lacy Period, 1825-1850. More than 1000 pieces are included in the exhibition.

• Roy S. Erickson has been named Assistant Manager of the Technical Service Department in the Michigan Alkali Division of Wyandotte Chemicals Corporation. He has been a member of Wyandotte's technical service team since 1951.

NEW GLASS COMPARATOR

By ALEXANDER SILVERMAN, Professor of Chemistry, Emeritus

University of Pittsburgh, Pittsburgh, Pa.

The writer has tried an experiment recently which may be of interest to glass technologists and perhaps even to individuals in fields other than glass. It was found desirable to compare the relative color tones of pastel colored glasses. These light colors are not readily comparable by laying rods together on a piece of white paper and so a sheet of No. 22 Styrofoam, which is pure white and two inches thick, was drilled with 7/16-inch holes half an inch apart. The size of the sheet was 8½ by 11 inches, a convenient size for filing in ordinary letter filing cabinets. It happens that the Styrofoam, which was provided by Monsanto Chemical Company, was used for the experiment. There are other white plastic foams which are equally applicable. The advantage of plastic foam over foam glass lies in the facility of cutting or sawing to size and of drilling with a wood bit or boring with an ordinary cork borer. The holes can be made of any desired size and as far as the sheets of white foam plastic are concerned, they could probably be of any thickness from half an inch to several inches.

A photographic ground glass of the same size as the foam glass host is attached to one side, by Scotch tape, with the ground surface in contact with the foam glass. To the other side one can fasten a sheet of cardboard, hinge-like, also with Scotch tape, so that this can be raised when the device is to be used.

The photographic ground glass plate can be held against a light bulb, fluorescent tube, or window for daylight effects, and comparative color tones can be studied in this fashion. They are, of course, entirely different when viewed by artificial sources and then by daylight.

The plastic foam comparators yield relative color values to the observer that the writer has never enjoyed with any other type of comparator. Present adaptability, of course, is for solids. Certainly for the light pastel shades, the two-inch thickness of foam plastic is satisfactory. For ruby and other darker colors, there is a possibility that half-inch thicknesses would be more desirable.

There are many plastic foams on the market today. The one which was applied in this particular instance is the white foam which is available in florists' shops. Interested individuals can probably purchase small quantities for trials.

ORGANIZATION CHANGES AT CORNING

In several organization changes recently announced by Corning Glass Works, Dr. William H. Armistead was appointed Manager of the Melting Department of the Research and Development Division, succeeding Dr. Frank Day, Jr., who has been named Supervisor of Chemical Engineering in the Manufacturing Staff Division.

Dr. Armistead joined the Corning organization in 1941 as a research chemist, advancing later to senior research associate. He is a graduate of Vanderbilt University where he received his bachelor's degree in chemical engineering, and his master's and doctor's degrees in chemistry.

Dr. Day also joined the glass company in 1941 as a research chemist. In 1947, he was named Manager of Melting Research, and in 1952 was assigned additional duties as Manager of Pilot Plant No. 1. Dr. Day received his bachelor's degree from the Ohio State University, and his doctor's degree in chemistry from University of Pittsburgh. Immediately prior to joining Corning, he was research engineer with Battelle Memorial Institute.

At the same time, announcement was made of the appointment of James L. Knapp as Manager of glass melting operations in the Glass Technology Staff Department of Corning. Mr. Knapp has been Manager of the company's Central Falls, Rhode Island, plant since 1947, and will be succeeded in that capacity by Clark A. Crawford, Production Superintendent of "A" Factory at Corning's main plant. F. Philip Hunt, quality and process engineer at Fall Brook, succeeds Mr. Crawford.

A graduate of Alfred University with a degree in glass technology, Mr. Knapp joined Corning in 1935 as a member of the works control laboratory staff. In 1940, he was transferred to the Wellsboro plant as a chemist, advancing to chief chemist the following year. Serving in a production capacity, Mr. Knapp was made Plant Manager at the Central Falls plant in 1947 and in 1949 was one of the 10 young business executives chosen in a nation-wide competition to receive an Alfred P. Sloan Fellowship at Massachusetts Institute of Technology.

Mr. Crawford, who is a graduate of Duke University, joined Corning in 1944 as an engineer in the research and development laboratory. Immediately prior to joining Corning, he was associated with Armour Research Foundation as a research engineer.

A graduate of Cornell University, Mr. Hunt began his career at Corning in 1949 in the general industrial engineering department at the main plant. In 1950, he was transferred to Fall Brook as industrial engineer and in 1953 was named plant quality and process engineer.

W. A. EDWARDS REJOINS OWENS-ILLINOIS

Walter A. Edwards, assistant administrator of the Business and Defense Services Administration of the U. S. Department of Commerce, left that post on June 15 to rejoin Owens-Illinois Glass Company.

Mr. Edwards, who was on loan from his company to the government under a rotation system in which experienced industry personnel are provided for this type of government service, will be assigned to the Washington office of the glass company. Mr. Edwards has been assistant BDSA administrator since October 1, 1953. Before that, he was consultant to the container and packaging division of the old N.P.A.

SEVENTH SYMPOSIUM ON CRYSTAL CHEMISTRY HELD AT RUTGERS UNIVERSITY

The Seventh Symposium on Crystal Chemistry as Applied to Ceramics, sponsored jointly by the Rutgers University School of Ceramics and the Ceramic Association of New Jersey under the direction of Dr. John H. Koenig, was held at Rutgers University in New Brunswick, N. J. on June 4, 1954. Dr. Harold T. Smyth, of the Rutgers School of Ceramics staff, served as chairman of the all-day meeting. The program, which included seven papers dealing in general with properties of silica, attracted over 100 persons to this annual session.

Dr. Robert B. Sosman opened the symposium with a paper on "A General View of the Known Phases of Silica". This paper was a review of several chapters of the author's "Properties of Silica" (1927), a second edition of which is now in preparation. Since Fenner (1912) straightened out the relationship between the three principal phases of silica (quartz, tridymite, cristobalite) and their high and low temperature modifications, the classification of phenomena has followed his outline, which included seven crystalline phases and one liquid-vitreous phase. New data obtained in the past 25 years make it necessary to recognize at least fifteen crystalline and two vitreous phases. Two of the new crystalline phases, coesite and keatite, which form the subject of later papers in the symposium, are produced under high pressure, and a condensed vitreous phase having the density of crystalline quartz has been produced by Bridgman's pressure technique. Continued work on structure and inversion-points may make it possible to decrease the number of distinct crystalline phases. The supplementary phenomena that accompany fine sub-division, especially in the micro-fibrous varieties of silica such as chalcedony, are being modified by the recognition of mechanical restraint as a factor in polymorphism.

Dr. James B. Austin, Research Laboratory, United States Steel Corporation, followed with a discussion on "The Coefficient of Linear Thermal Expansion of Tridymite". The occurrence of two "high-low" inversions in tridymite at 117° and 163°, respectively, is well-established. Heat content data reported in 1941 by Mosesman and Pitzer indicate the possible existence of a third transition at about 223°. As such transformations are commonly accompanied by a change in volume or length, measurements of thermal expansion offer a possible means of confirming the existence of this third transition. Accordingly, a number of measurements made some years ago on purified tridymite and on a silica coke-oven liner which, after long service, had been converted almost entirely to tridymite, have been reexamined. The results indicate the existence of an anomalous and sudden decrease in instantaneous expansion coefficient at about 210°C. Another analogous but smaller change seems to occur at 475°C. These data indicate that these transitions differ in nature from those which occur at 117° and 163°.

"The System $SiO\text{-}H_2O$" was the subject of the paper given by Dr. O. F. Tuttle, Department of Earth Sciences, College of Mineral Industries, Pennsylvania State University. The effect of pressure on the quartz-tridymite inversion has been determined up to 1,000 bars. Pressure raises the inversion temperature at the rate of 0.18°C. bar. This rate of increase of the inversion temperature is approximately one-fourth that calculated from thermo-dynamic data. Extrapolation of these values to higher pressures indicates that quartz will melt directly to a liquid at about 5,000 bars pressure. In the presence of water vapor, quartz melts directly to a hydrous liquid (containing on the order of 3 wt. percent water) at approximately 1175°C. and 1500 bars water vapor pressure. If this liquidus lowering continues at higher pressures, we may have here an explanation of the mechanism of formation of the quartz cores of pegmatites and the quartz veins in regionally metamorphosed rocks.

Dr. L. Coes, of the Norton Company, spoke on "Coesite: A Form of Dense Crystalline Silica". Using new techniques for working at high pressures and temperatures, a new form of crystalline silica has been produced. The new silica separates from a large variety of silica containing systems at pressures above 35,000 atmospheres in the temperature range of 500-900°C. It is best prepared by the action of mineralizing agents, such as ammonium phosphate, on powdered quartz. The new silica is remarkably stable. It is unchanged on heating to 1,400°C. At 1,500°C. or more, it changes to cristobalite and glass without change in weight. It is not soluble in hot concentrated hydrofluoric acid, but is dissolved by fused ammonium bifluoride. The refractive index, density and hardness are all substantially greater than that of normal quartz. The new silica crystallizes in hexagonal plates which belong to the monoclinic system. Its structure is now under investigation.

Paul P. Keat, also of the Norton Company, discussed "Keatite: A New Crystalline Phase of Silica". A new crystalline form of silica has been synthesized hydrothermally from amorphous silica. Addition of a very slight but critical quantity of an alkali or a basic, alkali salt allows formation of the new silica over the temperature range 385-575°C. and the pressure range 5,000-18,000 psi gage. The concentration is critical since too low an amount leads to cristobalite and too high an amount to quartz. The crystals obtained were up to 50μ and occurred as square platelets. They are uniaxial negative with $\epsilon = 1.513$ and $\omega = 1.522$. The density is 2.50 as interpolated from a plot of mean refractive index *vs* density for the known forms of silica. The unit cell is primitive, tetragonal with $a_0 = 7.46$ and $c_0 = 8.59$ and contains 12 formula weights of SiO_2. The new silica is thermally stable up to at least 1100°C. showing no inversions by differential thermal analysis with the equipment used. Inversion to cristobalite occurs at 1400°C. and probably also at lower temperature. Thermal dilatation measurements show a positive expansion parallel to the c-axis up to 550°C. and a negative expansion parallel to the a-axis up to about 250°C. at which point the true coefficient of expansion goes through zero, becomes positive and continues so up to 550°C. The calculated mean linear thermal expansion of an aggregate is negative up to 550°C. and is of the same order of magnitude as that of vitreous silica. β-spodumene appears to be a derivative structure with approximate, tetragonal unit cell dimensions of $a_0 = 7.5$ and $c_0 = 9.0$. Another derivative structure may be that of μ-cordierite. Resemblance to an "intermediate-I" found by J. Endell in the heating of silicic acid is noted.

"Neutron Diffraction in Vitreous Silica" was Dr. H. A.

Weber's contribution to the program. Dr. Weber is with the Department of Physics, St. Louis University. The structure of vitreous silica is being investigated by neutron diffraction methods employing the Argonne National Laboratory heavy water pile. Both differential neutron-scattering and total neutron-scattering methods have been applied. The former, following the standard liquid structure analysis of Zernicke-Prins for x-rays, involves tedious and somewhat uncertain corrections and normalization methods. The latter, employing the slow neutron velocity selector (chopper), results in a new method of analysis employing variable wavelength instead of variable scattering angle. The earlier results employing differential and total neutron scattering were compared with each other and with x-ray results for vitreous silica. Current work, involving consideration of inelastic scattering of neutrons, was discussed and results for ordinary fused silica and for high-purity, low crystalline content Corning fused silica were presented and compared with the earlier neutron results and with x-ray results. These latest results are in good agreement with the essential x-ray results indicating the basic tetrahedral structure of vitreous silica. Some important advantages of the neutron diffraction method were discussed.

A paper on "Ultrasonic Absorption in Fused Silica at Low Temperatures and High Frequencies" by O. L. Anderson, H. E. Bommel and H. J. McSkimon, of the Bell Telephone Laboratories, and presented by Dr. Anderson concluded the symposium's program. The absorption of high frequency (60 KC/sec — 20MC/sec) sound waves in fused silica shows a large peak at low temperatures (30°K — 50°K). This absorption appears to result from some property of the glassy state since the absorption does not occur in crystalline silica. Data were presented showing the variation of rigidity and internal friction with temperature and frequency. It was shown that the source of the internal friction is a structural relaxation. Some speculations were made on the nature of the structural relaxation, and its relation to the glassy state.

The Eighth Symposium on Crystal Chemistry as Applied to Ceramics will be held next year at Pennsylvania State University, State College, Pa.

THATCHER'S McKEE DIVISION EMPLOYS INDUSTRIAL DESIGNER

The McKee Glass Division of Thatcher Glass Manufacturing Company has announced that it has contracted for the services of Gerald Stahl, New York industrial designer, as part of its over-all program for strengthening the quality and appeal of McKee lines. Mr. Stahl will superintend development of new lines, as well as work with present products toward increased style in both glassware and display cartons.

After studying the present McKee products, Mr. Stahl expressed his immediate goals as the opening up of new markets for present products through increased sales acceptance by improved designs and improved packaging, and the development of new products, especially with an eye toward the specific needs of those fields of market potential as yet undeveloped.

• A price increase of 15 cents per cwt. on all grades of caustic soda was announced by Diamond Alkali Company, effective July 1, 1954, on all contracted business.

G.C.M.I. NAMES BUSH BARNUM AS INFORMATION DIRECTOR

Bush Barnum has been named Director of Information of the Glass Container Manufacturers Institute, Inc., according to an anouncement by Victor L. Hall, Institute General Manager.

Mr. Barnum was associated with Benjamin Sonnenberg from 1946 to 1953. Prior to that, he was with Benton & Bowles, Inc., for six years. From 1938 to 1940, Mr. Barnum was assistant New York correspondent of the *Financial Times* of London. He has also worked for *Newsweek* Magazine and for *The Wall Street Journal.*

GLASS COMPANIES RECEIVE HONORABLE MENTION IN PRODUCT LITERATURE COMPETITION

Corning Glass Works and Pittsburgh Corning Corporation received Honorable Mention in the 1954 Product Literature Competition sponsored jointly by The American Institute of Architects and The Producers' Council, Inc. The criteria upon which the awards were based included completeness, organization of material and convenience of reference.

Corning received its award for a handbook of lighting glassware published by its Lighting Sales Department. Entitled "Architects and Engineers Handbook of Lighting Glassware", the book gives complete information on the wide variety of Corning lighting glassware products.

Pittsburgh Corning received Honorable Mention for its catalogs, "PC Glass Blocks for Industrial, Commercial and Public Buildings" and "Foamglas, for Industrial, Commercial and Public Buildings".

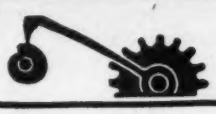
FOOD MACHINERY CHEMICAL DIVISION APPOINTMENT

Dr. Carl F. Prutton has been appointed Vice President and Technical Director, Chemical Divisions, Food Machinery & Chemical Corporation, it has been announced by Paul L. Davies, President of the firm. He will report to Ernest Hart, Executive Vice President, and will be located in New York City.

Dr. Prutton graduated from Case Institute of Technology in 1920, remaining on the staff of the Institute as an instructor. He later served with the War Production Board, Dow Chemical Company and the Lubrizol Corporation. In 1948 he joined Mathieson Chemical Corporation as Director of Research and a year later was appointed Vice President and Director of Operations, Engineering and Research.

• Fred E. Fuller, General Counsel for Owens-Illinois Glass Company and senior partner in the law firm of Fuller, Harrington, Seney and Henry, has been re-elected to a five-year term as trustee of Ohio Wesleyan University. Mr. Fuller also serves as General Counsel for the Glass Container Manufacturers Institute.

Inventions and Inventors



Annealing and Tempering

Thermal Treatment of Glass Objects. Fig. 1. Patent No. 2,670,573. Filed February 13, 1950. Issued March 2, 1954. One sheet of drawings. Frederick W. Sullivan, Jr.

A unique method of thermal treatment of glass and similar vitreous articles is presented. It consists of the accurate control of the application or abstraction of heat through the agency of finely divided solids in pseudoliquid form. By this method, shown in Fig. 1, such operations as the annealing, cooling, tempering and opalizing of glass can be controlled extremely well.

On passing a gas upward through a bed of finely divided solid particles, for example, particles passing through a 100-mesh sieve but retained on a 400-mesh sieve, a point is reached at a superficial linear gas velocity of about one foot per second at which the solid particles assume a pseudoliquid state.

The necessary amount of gas to maintain the solid particles 2 in pseudoliquid form is introduced through the perforations in grid 3. To maintain the high temperature conditions required for the processes, gas in line 10 and air in line 11 may be mixed and burned in furnace setting 12 and the resulting combustion products passed to receptacle 1 through orifice 13.

The temperature level in bed 2 may be maintained at any desired point by manual control or automatic means. For continuous annealing, a production item, e. g., a parison or bottle blank, may, from the "take out" position, be loosely inserted in holes in an endless chain conveyor 25 which is moved mechanically through the pseudoliquid bed of solid particles at such a rate that the objects are annealed. This may be accomplished by passing the endless conveyor 25 carrying the objects 26 into dip leg 27 leading to bed 2. The conveyor and its load moves through bed 2 at a rate necessary to anneal the objects. By controlling the temperature of the pseudoliquid bath 2 and the speed of conveyor 25, various heat treatments can be accomplished as desired.

The patent contains 10 claims and 11 references were cited.

Furnace for Annealing Glass. Fig. 2. Patent No. 2,669,068. Filed August 13, 1948. Issued February 16, 1954. One sheet of drawings. Ovide Wambreuze.

The annealing of glass is a very delicate operation. The best results are obtained by causing currents of air at the desired temperatures to circulate in direct contact with the glass.

The chambers 7 of the heated part of the furnace are equipped so as to be traversed by currents, in closed circuit, which are directed transversely to the path of the charges, alternately upwards and downwards, as shown by the arrows in Fig. 2. This result is most effectively produced by providing each chamber 7 with two fans, one fan 8 at the upper part and the other fan 9 at the lower part, offset with respect to one another in the longitudinal sense of the furnace. Heating batteries 10, 10, formed, for example, by electrical resistances, are placed under the ceiling of the furnace and constitute a radiating ceiling above the charge to be annealed.

This arrangement enables a very active air circulation to be produced. The continuity of the contact of the air with the charge and the reversal of the direction of the currents insures a high efficiency of the heat exchange, with reduced heat consumption, and the duration of the treatment can also be greatly reduced in comparison with the treatment in the usual furnaces.

The patent contains 4 claims and 11 references were cited.

Glassware Annealing Method and Apparatus. Patent No. 2,669,069. Filed November 24, 1950. Issued February 16, 1954. Three sheets of drawings (none reproduced). Assigned to Emhart Manufacturing Company by Donald G. Merrill.

The present invention involves an abrupt departure from the prior art and proceeds in a direction exactly opposite to that taught by the art. After strong recirculation of air in the lehr at the location where the lower annealing or a lesser temperature is established, the ware is thereafter shock-cooled at a rapid rate such that all ware which is inherently weak to heat shock, including cordy, non-homogeneous, checked and mold marked, is destroyed and only homogeneous ware survives. The rapid shock-cooling of this invention involves an abrupt temperature drop in the lehr of approximately 150°.

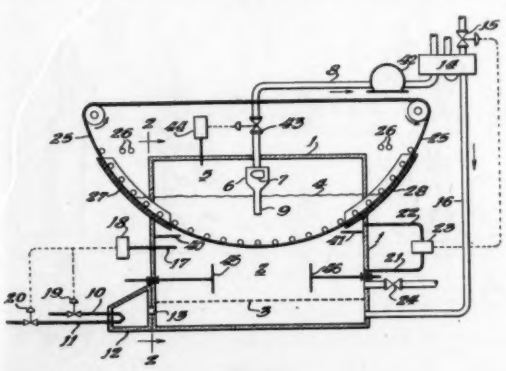


Fig. 1.

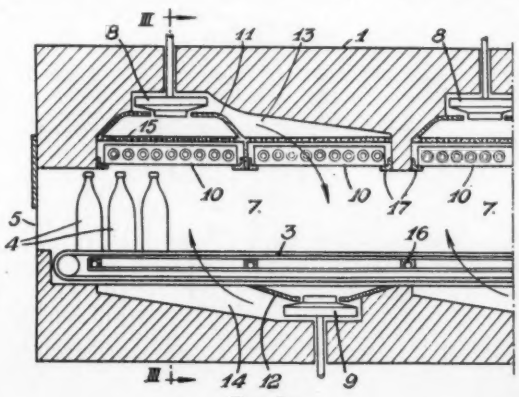


Fig. 2.

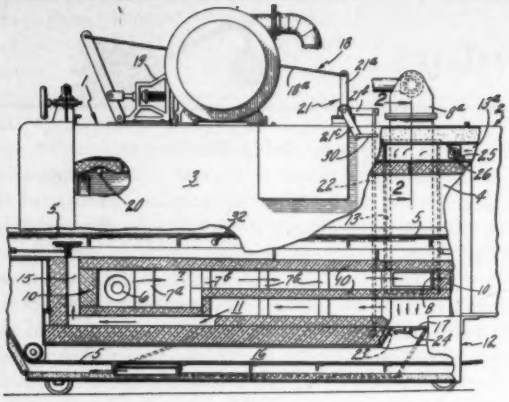


Fig. 3.

300°F., the higher limits applying to thin ware. The ware leaving the strong recirculation point preferably is carried immediately into a stream of air at the shock temperature which is maintained at the preselected value below the recirculation temperature to destroy all glassware not having the requisite homogeneity. While the recirculation temperature is preferably at or close to the lower annealing point for the glass, it may be somewhat lower but above 400°F.

Introduction of heat shock requires careful control to produce neither more nor less than the desired and intended effect. It has been found that in order to make the transition as prompt as possible, a cooling blast should be introduced transversely of the lehr and preferably beneath, and directed against the bottom of the ware so that the blast does not move longitudinally through the lehr and entrain other air which might effect a gradual rather than the desired abrupt change. By introducing the chilling blast through the belt directly against the bottom of the ware, that portion of the ware which normally is most vulnerable to heat shock is most effectively exposed to it.

The patent contains 12 claims and the following references were cited: 1,979,216, Morton et al., Oct. 30, 1934, and 2,133,784, Merrill, Oct. 18, 1938.

Lehr. Fig. 3. Patent No. 2,669,070. Filed April 14, 1951. Issued February 16, 1954. One sheet of drawings. Assigned to Emhart Manufacturing Company by Constantine W. Kulig.

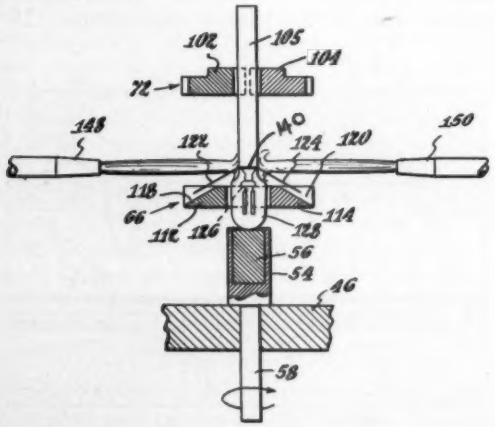


Fig. 4.

The present invention relates to improvements in apparatus for annealing glassware. It automatically provides for the small amount of recirculating air required for best fuel economy at light loads and for automatically increasing the amount of recirculating air and drawing more cooling air from between the forced cooling and the annealing zones for heavier loads.

After fuel is ignited at the burner 6, its combustion is completed in the chamber 7 forward of a first baffle 7a which divides and directs the combustion gases through passageways which are at opposite sides of the lehr and which are baffled as at 7b so as to assure maximum heat extraction from the gases before they pass through the two up-take vents 8 and 9. Independently controlled ejectors 8a and 9a (not shown) and a suitable blower, such as is shown mounted on the top of the firebox section (Fig. 3), may be provided at the top of the up-takes for the necessary draft to draw the gases from the chamber 7 and for regulating the portions of heat distributed to the opposite sides of the tunnel.

The flues 13a and 14a are each provided with a damper 25 for throttling the rate at which air is withdrawn from the tunnel and discharged into the downcomers 13 and 14. The amount of air returned through the ducts 13a and 14a (not shown) is regulated automatically by the dampers 25 which are adjusted in direct response to changes in the temperature of the thermostat 20 and indirectly in response to indraft or outdraft at the entrance to the lehr.

The patent contains three claims and the following references were cited: 1,783,208, Williams, Dec. 2, 1930; 2,275,263, Merrill, Mar. 3, 1942; and 2,507,673, Merrill, May 16, 1950.

Feeding and Forming

Magnetic Insert for Sealing Heads. Fig. 4. Patent No. 2,672,711. Filed November 28, 1951. Issued March 23, 1954. Two sheets of drawings. Assigned to Westinghouse Electric Corporation by J. C. Nash.

This invention relates to sealing machines and, more particularly, to a magnetic insert for a sealing head of a butt-sealing machine. The operator inserts a bulb 128 between the jaws 112 and 114 of assembly 66. A mount 126 is then inserted into the open end of bulb 128 and a tubulation 105 is positioned on the bulb between the open jaws 102 and 104 of assembly 72. The insert 56 exerts a magnetic force on the nickel electrodes 142 and 144 of the mount 126, thereby centering the mount within the bulb 128. As the sealing head 10 rotates between

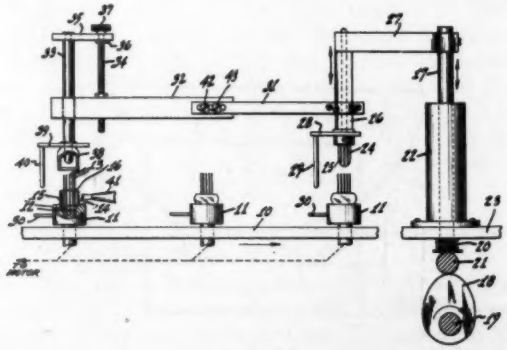


Fig. 5.

sealing fires 148 and 150, as shown in Fig. 4, the tubulation 105 and the open neck of the bulb 128 are sealed together with the lead wires 122 and 124 of the mount 126.

After a suitable automatic exhaust, which may comprise a bake, cathode sintering, electrode outgassing and a suitable final fill, the lamp is tipped off in the constricted area of the tubulation 105 and a base 140 affixed with a suitable cement. The magnetic insert holds the miniature lamp mount 126 in a bulb 128 so that sealed lamps having off-center mounts are eliminated.

The patent contains 3 claims and the following references were cited: 1,716,167, Grogan, June 4, 1929; 1,742,153, Stiles et al., Dec. 31, 1929; 2,021,001, Donovan et al., Nov. 12, 1935; and 2,549,359, Bakanau, Apr. 17, 1951.

Glassworking Apparatus and Method. Fig. 5. Patent No. 2,671,291. Filed June 29, 1950. Issued March 9, 1954. Two sheets of drawings. Assigned to Radio Corporation of America by C. W. Daley.

The invention relates to an apparatus and method for making a composite glass-metal sub-assembly for an electron tube. In operation, Fig. 5, a sealing pin 11 loaded with work pieces comprising a glass tube 16 and a plurality of lead-ins 13 is indexed into position below the glass forming member 38. This member, as well as the straightening die 25, are held in raised position by cam 19 during movements of the turret. When an indexing movement of the turret is completed, cam 19 releases pressure on arm 21 resulting in a downward movement of the straightening die 25 and the glass forming member 38 in response to the downward force exerted by spring 20.

The downward movement of member 38 causes its lower trim to engage the upper end of the glass tube 16 now partly softened by the flame from burner 41, and to exert a downward force thereon. Since the force applied by the member 38 to the tube 16 is vertical, the glass of the tube is pushed downwardly parallel to the lead-ins 13. This assures a desired spacing between the upper portion of the tube and the lead-ins.

This doughnut from which the tube is given by the apparatus, according to the invention, not only maintains separation between the glass and the lead-ins during its formation, but also aids in preventing undesired glass adherence to the lead-ins during the subsequent stem forming operations. It will be noted that the two operations of glass working and lead-in straightening are performed during a single actuation of shaft 17 by spring 20. Furthermore, the apparatus of the invention may utilize conventional stem-making machines in combination with a glass forming assembly with a minimum of change in the machine.

The patent contains 4 claims and the following references were cited: 796,470, Swan, Aug. 8, 1905; 1,640,442, De Jong, Aug. 30, 1927; 1,965,408, Eden et al., July 3, 1934; 1,195,483, Franke, Apr. 2, 1940; 2,306,163, Greifendorf, Dec. 22, 1942; 2,324,385, Gustin et al., July 13, 1943; and 2,497,545, Greiner, Feb. 14, 1950.

Feeder For Molten Glass. Fig. 6. Patent No. 2,669,806. Filed December 8, 1951. Issued February 23, 1954. Three sheets of drawings. Edmond Van de Walle, Charles Van de Walle and Emile Bonnefoy.

This invention is related to a rotary blowing machine used in the manufacture of articles such as lamp bulbs, flasks or other thin hollow articles. The machine is of the type described in U. S. Patent No. 2,405,557.

The mechanism operates as shown in Fig. 6. Under the mechanical action of the movable head associated with the action of inner depression, the mass of glass 1 is suitably spread, flattened out and shaped over the receiver plate 4.

As soon as the head 6 has arrived into vertical register with a drawing-out port 10 of the work-table 11, a reduced pressure no longer acts inside the movable head and compressed air is admitted to this end. Under the action of the compressed air, the suitably shaped mass of glass from the lower part of the head 6 drops into the table 11 on which head 6 is in perfect vertical register with one of the drawing-out ports 10 of the casting table. The mass of glass is then carried along in its rotary movement by the casting table 11 in order to be submitted to the successive operations required in the production of the final object to be molded.

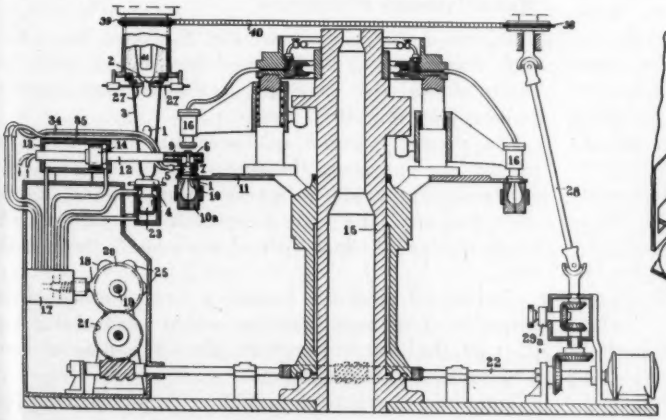


Fig. 6.

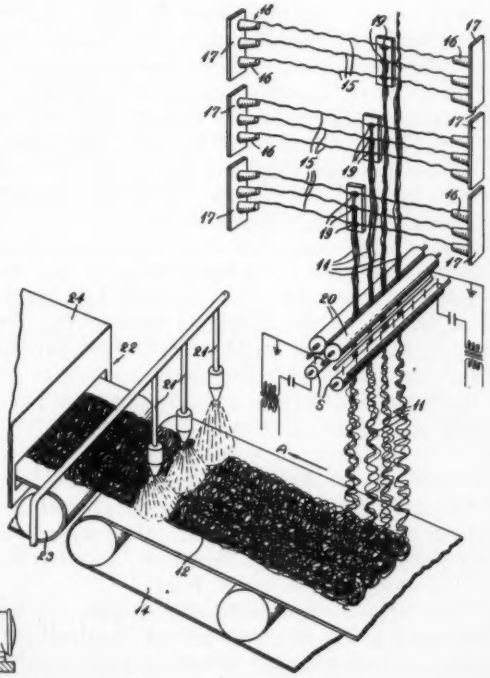


Fig. 7.

The patent contains six claims and the following references were cited: 1,260,637, Canfield, Mar. 26, 1918; 1,271,961, Teeple, July 9, 1918; 1,415,824, Ferngren, May 9, 1922; 1,845,491, Eckert, Feb. 16, 1932; 1,845,525, Sloan, Feb. 16, 1932; and 2,405,557, Bonnefoy-Cudraz, Aug. 13, 1946.

Glass Wool and Fiber

Method of Making Looped Glass Fiber Mats and Laminates. Fig. 7. Patent No. 2,671,745. Filed June 28, 1950. Issued March 9, 1954. Three sheets of drawings. Assigned to Owens-Corning Fiberglas Corporation by Games Slayter.

This invention relates to processes of making glass fiber mats for reinforcing resins. The object is to provide a process of making a thin glass fiber mat having a high concentration of fibers in bundles that in turn are distributed throughout the mat with such uniformity as to afford extremely high impact and flexural strength to any plastic or resinous body in which the mat is incorporated.

The apparatus, schematically shown in Fig. 7 of the drawings, comprises an endless belt conveyor 14 adapted to be driven by any suitable mechanism in the direction of the arrow A. Fibrous glass yarns 15 are packaged on spools 16 suitably mounted above the conveyor 14 on a frame 17 in banks or tiers to form a creel 18 and are arranged so that the yarns can be drawn off the ends of the packages or spools through a series of guide eyes 19. The creel 18 is arranged so that a plurality of strands 11 are substantially uniformly spaced across the width of the conveyor 14. As the mat of fibrous glass is formed on the conveyor 14, it has applied a suitable binder from spray heads 21 and is conveyed through a heating zone 22 by a second endless belt-type conveyor 23. Heat may be applied to the underside of the mat as it is conveyed through the space between the conveyors, so as to partially cure the resin and thereby prevent the mat from adhering to the conveyor 23 while it is being advanced through the heating zone 22.

Various thermosetting condensation products may be used as a binder, such, for example, as phenol formaldehyde. This extensibility of the mat is particularly advantageous in cases where the mat is used as a reinforcement for plastics or resinous bodies to be formed by deep drawing or similar operations.

This patent contains 2 claims and the following references were cited: 1,365,061, Respess, Jan. 11, 1921; 1,914,801, Chadwick, June 20, 1933; 2,076,343, Humphner, Apr. 6, 1937; 2,224,274 Powers, Dec. 10, 1940; 2,392,882, Roberts, Jan. 15, 1946; 2,429,486, Reinhardt, Oct. 21, 1947; 2,546,230, Modigliani, Mar. 27, 1951; 2,577,214, Slayter, Dec. 4, 1951; and 2,638,146, Rounseville et al., May 12, 1953.

Receiving Mechanism for Drawn Glass Strands. Patent No. 2,664,671. Filed April 4, 1951. Issued January 5, 1954. One sheet of drawings (none reproduced). Assigned to International Harvester Company by Joseph F. Courtney and Adelbert C. Radtke.

The application of plastic-coated glass strands to conventional spools results in many difficult problems as the relatively sticky strand becomes a solid mass. In order that the strand does not fluff up or matt in cake form, new receiving devices are necessary. With the improved apparatus, the plastic-coated glass fiber is delivered to a wire mesh container or a staved container. It is delivered at high speeds with great quantities of air entrapped due to the rapid movement of the strand and to the drawing air of the nozzle.

The strand is preferably delivered at some point in the container spaced from the vertical axis or center line of the cylindrical containers. Upon rotating the container, the strand is deposited for piling on the solid bottom of the container forming an overlapping circular pattern. The wire mesh wall of the container permits rapid easy escape of the turbulent air currents accompanying the drawn strand, thus permitting the strand to lie in a smooth even pattern.

The novel receiving device thus eliminates the undesirable turbulent effects of the air accompanying a drawn strand and provides a smooth even packaging of the glass strand by constantly dissipating the air through perforated side walls.

The patent contains 2 claims and the references cited were as follows: 954,451, Merrell, Apr. 12, 1910 and 2,441,660, Manning, Nov. 26, 1946.

Apparatus for Treating Glass Fiber Cloth. Patent No. 2,667,568. Filed March 8, 1950. Issued January 26, 1954. One sheet of drawings (none reproduced). Albert Ferier.

The invention has for its object a method for the thermal treatment of glass fiber cloth. The purpose of this treatment is to eliminate, or at least to reduce the relatively characteristic rough feel touch of the cloth, due to the very great stiffness of the glass fibers. According to the invention, the glass fibers of the cloth to be treated are heated by dielectric losses, by applying a high frequency alternating electric field of a strength, duration and frequency such that they are brought to their softening temperature and adopt the shape given them by the interlacing of their weaving. The equipment for carrying out the method includes a high frequency electric power supply, at least two electrodes connected respectively to the two poles of the said supply and means adapted to feed the cloth to be treated between the electrodes.

The patent contains one claim and 16 references were cited.

Miscellaneous Processes

Improved Annealing Lehr. Fig. 8. Patent No. 2,660,832. Filed April 6, 1951. Issued December 1, 1953. Six sheets of drawings. Assigned to Emhart Manufacturing Company by Donald G. Merrill.

The present invention relates to improvements in apparatus for annealing glassware. Heat is supplied at a single location in which the temperature gradient through the entire annealing cycle is controlled by automatically regulating longitudinal drift of atmosphere through the lehr.

The lehr includes a firebox 1 (not shown), which forms the conditioning zone portion of a tunnel that supplies all the heat required to effect annealing of ware passing through the lehr tunnel.

Extending rearwardly in Fig. 8 from the annealing

(*Continued on page* 396)

Research Digest

The Dielectric Constant and Dissipation Factor of Soda-Potassia-Silica Glasses at Frequencies of 1 to 300 Kilocycles at Room Temperature

The electrical characteristics of glasses have become an increasingly important subject during the past few years for both practical and theoretical reasons. Several recent research investigations have yielded much empirical information about the relationship between glass compositions and electrical properties. It has been possible to correlate some of these results with the generally accepted theories of the constitution of glass. More frequently, however, the glasses used in these studies have been of such a complex nature that theoretical interpretations of results are impossible and data have to be accepted solely for their empirical value.

The present investigation by G. F. Stockdale (University of Illinois Engineering Experiment Station, *Bulletin Series No. 411*, April 1953) was undertaken as a fundamental study to determine the basic relationships between dielectric constant, dissipation factor, and composition of the two- and three-component soda-potassia-silica glasses.

Several previous research investigations have shown that the electrical properties of glasses do not vary linearly as soda is replaced by potassia. In one of the earliest studies, Gehlhoff and Thomas measured the a-c conductivity of several groups of glasses and determined the temperature at which each composition had a conductivity of 100×10^{-10} Mhos per cm cubs (ohms $^{-1}$—cm^{-1}). For two series—one containing 85 per cent SiO_2 and 15 per cent alkali ($Na_2O + K_2O$), the other containing 75 per cent SiO_2 and 25 per cent alkali—the mixed alkali glasses had to be heated to higher temperatures to reach this conductivity value than did the glasses containing either alkali constituent alone. Maximum temperatures were required for the 85 per cent SiO_2 glass containing 3.5 per cent Na_2O and for the 75 per cent SiO_2 glass with 7 per cent Na_2O. On the basis of these limited results, it was concluded that the conductivity minimum is related to a fixed soda-potassia ratio and that this ratio is independent of the total alkali content of the glass.

Stevels presented results on four series of glasses which substantiate the presence of this minimum value. In each of these glasses, three of which contained 18 per cent ($Na_2O + K_2O$) and the fourth 11.7 per cent ($Na_2O + K_2O$), dielectric loss minima were found at approximately 4 per cent Na_2O content.

Moore and DeSilva found a similar minimum value for power factor at 4 per cent Na_2O in a series of glasses containing 74 per cent SiO_2, 10 per cent CaO and 16 per cent ($Na_2O + K_2O$).

Stevels has further pointed out that the position of these minimum values probably depends on the other constituents in the glass and it may be fortuitous that, in most investigations thus far, the minima have occurred at 4 per cent soda content.

In a recent investigation, for a series of glasses containing 53.3 mol per cent SiO_2, 10.2 mol per cent PbO, 4.5 mol per cent CaF_2, and 32 mol per cent ($Na_2O + K_2O$), Stevels found a minimum value for power factor at 14.2 mol per cent Na_2O, 17.8 mol per cent K_2O.

These varying results prompted the present investigation. It was anticipated that the study of simple soda-potassia-silica glasses would furnish results clarifying the relationship between the extreme values of the dielectric properties and the Na_2O/K_2O ratio in glasses.

A total of 35 glass compositions varying by 5 per cent intervals from 60 to 80 per cent SiO_2, 0 to 40 per cent Na_2O, and 0 to 40 per cent K_2O were melted for this investigation. All batches were calculated on a weight per cent basis to yield 400 grams of glass. The raw materials used were Reagent Grade sodium and potassium carbonate and Ottawa Silica which analyzed 99.82 per cent SiO_2, 0.019 per cent Fe_2O_3, 0.049 per cent Al_2O_3, 0.012 per cent TiO_2, 0.006 per cent CaO, 0.031 per cent MgO and 0.070 per cent loss on ignition. These minor impurities were ignored in making the batch calculations. The batch ingredients were weighed to 0.02 grams and thoroughly mixed in a quart jar by rotating for 1 hr. on a jar tumbler operating at 15 rpm. All the glasses were melted in covered platinum-10 per cent rhodium crucibles in a Globar electric furnace. The melting times and temperatures were adjusted to suit the refractoriness of the glass.

Each finished specimen was annealed by heating it in an electric furnace to a temperature at which all strain was relieved and then cooling it overnight at the constant rate of 0.4 deg. C. per min. The furnace cooling rate was controlled by progressively decreasing the furnace voltage. The maximum annealing temperature for each glass was determined by heating one of the annealing slugs in an open tube furnace and measuring the temperature at which all evidence of strain was removed when the sample was observed in polarized light with a Babinet Compensator. This temperature also proved to be the lowest temperature at which pressure could be applied to the discs during the flattening operation.

"Dielectric constant", as used in this study, is defined as the ratio of the capacitance of a capacitor having the test material as a dielectric to the capacitance of another capacitor with identical electrode configuration, but with air as the dielectric. The edge corrections for a two-electrode capacitor with equal circular electrodes reported by Scott and Curtis were applied to the measured capacitance of the samples before calculating the dielectric constants. The equivalent air capacitance was calculated from the electrode diameter and the average sample thickness, assuming the dielectric constant of air as unity.

The dissipation factor is the ratio of resistance to reactance of a capacitor. It is the reciprocal of Q, the storage factor. For values less than 0.15, it differs from the power factor by less than 1 per cent.

The dielectric constant and dissipation factor values

(*Continued on page* 388)

DIAMOND ALKALI MAKES EXECUTIVE CHANGES

W. H. Evans

The appointment of William H. Evans as Vice President of Diamond Alkali Company has been announced by President John A. Sargent following action by the Board of Directors. At the same time, four other important promotions in the company's management organization were also announced.

John W. Mantz, Assistant General Manager of Diamond's Painesville plant since 1950, was named General Manager of the newly-created Silicate, Detergent, Calcium Department. L. T. Welshans, for the past seven years Technical Director of the Painesville plant technical staff, has been named General Manager of the newly-created Cement and Coke Division. C. R. Brown, Manager of Industrial Relations at Painesville since April 1950, moves up as Assistant Works Manager, succeeding Mr. Mantz, and Robert McConnell succeeds Mr. Brown.

Mr. Evans joined Diamond Alkali in 1937 in a sales capacity, and with the exception of fours years' service in the U. S. Navy during World War II, has occupied a number of important posts, including that of treasurer. During the past six years, Mr. Evans has been Manager of silicate operations encompassing six plants.

To his new assignment as a division manager, Mr. Mantz brings a record of 25 years on the production side of the alkali industry. He joined Diamond in 1946 from Mathieson Chemical Company. In 1948, Mr. Mantz was made Industrial Relations Manager at Painesville, leaving that post two years later and returning to plant operations as Assistant General Manager at Painesville. He is a chemical engineering graduate of Virginia Polytechnic Institute.

Mr. Welshans, who joined Diamond in 1944 as Development Project Manager, later became Manager of the Development Department. He is a graduate of the University of West Virginia.

Mr. Brown, who joined the firm in 1950 as Industrial Relations Manager, was for many years previously associated in important personnel and labor relations posts with the Sinclair Refining Company and the National Enameling and Stamping Company. He is a graduate of the University of Pennsylvania.

• Paul E. Dreisbaugh has been named Personnel Manager of the Waterville, Ohio, plant of Glass Fibers, Inc. Mr. Dreisbaugh joined Glass Fibers from the U. S. Department of Labor where he had served as an investigator.

Errata: In the April 1954 issue of THE GLASS INDUSTRY, Page 252, second column, second paragraph, reference is made to, "The new form of silica had a density of 2.31 and was quite stable." The density of the new form of silica should have been 3.01.

J. J. DUGGAN NAMED WALSH VICE PRESIDENT

As the newly-elected Vice President of Glass Refractories Sales for Walsh Refractories Corporation, J. J. Duggan brings to his new position thirty-five years of significant experience and training.

Born in St. Louis, Mr. Duggan was educated in private schools and St. Louis University. Honorably discharged from the Army in December 1918, he was an Officer Candidate at the time of the World War I armistice.

For 17 years an employee of the old Parker-Russell Mining and Engineering Company, he resigned his position as Sales Manager of that organization in May 1936 to accept a position with the Walsh Refractories Corporation and has been associated with that company ever since in engineering and glass refractory sales. In May 1953, he was appointed Sales Manager of Glass Rrefractory Sales, which position he held until his present appointment.

GLASS DIVISION FALL MEETING

The Fall Meeting of the Glass Division of the American Ceramic Society will be held October 7 through 9 at the Mellon Institute, Pittsburgh, Pa.

L-O-F PLANT PARTIALLY SHUTS DOWN

Rapid increase of imports of European window glass made under low-wage conditions has resulted in shutting down another production furnace and an experimental window glass tank at the Charleston, West Virginia, plant of Libbey-Owens-Ford Glass Company, causing the layoff of approximately 240 employees.

Jennings Backus, President of Local 1 of the Federation of Glass, Ceramic & Silica Sand Workers of America, CIO, said the influx of cheap foreign glass has resulted in a total of nearly 500 seniority layoffs at Charleston since the end of 1953. He said that bad effects of the glutting of the window glass market by the cheap foreign product have not been confined to Charleston. Reductions have been made in other large plants. A. G. Barton, Plant Manager at Charleston, said the curtailment reduced operations to three out of the plant's six window glass production furnaces.

STAUFFER ADDS TO TECHNICAL SALES STAFF

Alfred N. Wohlwend has joined the technical sales staff of Stauffer Chemical Company, according to an announcement by T. A. Haschke, Director of Sales of the Industrial Chemicals Division.

Mr. Wohlwend, a chemical engineering graduate of the University of Michigan, is a specialist in the marketing of organic chemicals. He was formerly President of the Gator Chemicals, Inc. Mr. Wohlwend will headquarter in the Stauffer New York office.

Current Statistical Position of Glass

Employment and payrolls: Employment in the glass industry during April 1954 was as follows: *Flat Glass:* According to preliminary figures, employment during April fell off slightly to reach 25,000. This is 1.1 per cent below the 25,200 reported for March. *Glass and Glassware, Pressed and Blown:* During April, preliminary figures showed that 78,100 persons were employed. Compared with the previous month's 78,200, a drop of only .1 per cent is indicated. *Glass Products Made of Purchased Glass:* A preliminary 13,600 persons were employed during April. This is 4.2 per cent below the 14,200 employed during March.

Payrolls throughout the glass industry during April were: *Flat Glass:* A preliminary $10,486,667 was reported to have been paid out during April. Compared with the previous month's adjusted total of $10,524,800, a drop of .3 per cent is shown. *Glass and Glassware, Pressed and Blown:* Preliminary figures show that $23,514,348 was paid out during April. This is 1.1 per cent below the adjusted $23,886,711 reported for March. *Glass Products Made of Purchased Glass:* Preliminary figures reveal payrolls of $3,458,797 during April. Compared with the previous month's adjusted payroll figure of $3,722,151, a drop of 7 per cent is shown.

Glass container production, based on figures released by the Bureau of Census, rose during May 1954 to reach a total of 11,548,000 gross. Compared with April production of 10,460,000 gross, a rise of 10.4 per cent is shown. During May 1953, production was 11,001,971 gross, or 4.9 per cent below May this year. Total glass container production at the end of the first five months of 1954 has reached 52,773,616 gross. Compared with the corresponding period of 1953 when production was 50,282,542 gross, 1954 production is running 4.9 per cent ahead of 1953.

Shipments for glass containers during May 1954 also were on the increase and were reported to be 11,071,000

(*Continued on page* 386)

GLASS CONTAINER SHIPMENTS
(All Figures in Gross)

	May, 1954
Narrow Neck Containers	
Foods	1,365,000
Medicinal & Health Supplies	1,005,000
Chemicals, Household & Industrial	756,000
Beverages, Returnable	879,000
Beverages, Non-returnable	124,000
Beer, Returnable	322,000
Beer, Non-returnable	846,000
Liquors	736,000
Wines	315,000
Toiletries & Cosmetics	664,000
Sub-total (Narrow)	7,012,000
Wide Mouth Containers	
Foods	*2,693,000
Dairy Products	196,000
Medicinal & Health Supplies	380,000
Chemicals, Household & Industrial	176,000
Toiletries & Cosmetics	206,000
Packers' Tumblers	176,000
Sub-total (Wide)	3,827,000
Total Domestic	10,839,000
Export Shipments	232,000
TOTAL SHIPMENTS	11,071,000

* This figure includes Fruit Jars and Jelly Glasses.

GLASS CONTAINER PRODUCTION AND INVENTORY
(All Figures in Gross)

		Production May 1954	Stocks May 1954
Foods; Medicinal & Health Supplies; Chemicals, Household & Industrial; Toiletries and Cosmetics	Narrow Neck	4,024,000	4,166,000
	Wide Mouth	*3,836,000	*4,512,000
Dairy Products		219,000	331,000
Beverages, Returnable		926,000	1,548,000
Beverages, Non-returnable		131,000	174,000
Beer, Returnable		285,000	470,000
Beer, Non-returnable		794,000	899,000
Liquors		799,000	1,000,000
Wines		381,000	467,000
Packers' Tumblers		153,000	178,000
TOTAL		11,548,000	13,745,000

* This figure includes Fruit Jars and Jelly Glasses.

Table 1. PRESSED AND BLOWN GLASSWARE (EXCEPT GLASS CONTAINERS): VALUE OF SHIPMENTS BY CLASS OF PRODUCT, 1949-1953

Class of product	Value (thousands of dollars)				
	1949	1950	1951	1952*	1953
TOTAL	$242,418	$324,696	$324,939	$324,599	$361,865
Machine-made table, kitchen, art and novelty glassware	63,023	72,493	76,487	78,681	81,951
Hand-made table, art and novelty glassware	30,737	29,510	31,590	30,113	30,335
Cooking ware (heat-resistant, heat-treated and annealed)	8,436	10,977	12,550	14,920	14,807
Lighting glassware	76,956	133,268	108,102	115,831	146,549
All other pressed and blown glassware (except glass containers)	63,266	78,448	96,210	85,054	88,223

* Revised.

New Equipment and Supplies

CATHODE RAY TUBE EXHAUST OVEN

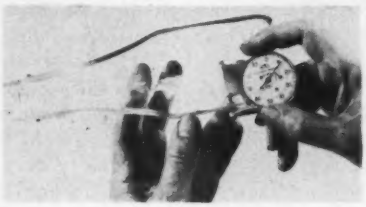
Steiner-Ives Company, 333 Springfield Road, Union, New Jersey, has announced development of what they state is the world's largest cathode ray tube exhaust oven for the production of 21″, 24″ and 27″ TV picture tubes. The exhaust oven's length, over 300 feet, enables the production of bigger and better picture tubes and also provides an additional safeguard against glass strain and breakage by permitting the tubes to leave the machine at only slightly above room temperature.

The interior of the exhaust oven is stainless steel lined, assuring maximum protection against deterioration caused by high heat. Another important aspect of design is the manner in which the 130 specially engineered tube exhaust carts travel through the oven. Undesirable floor rails are eliminated. Instead, the tube exhaust carts are supported from the side and a conveyor chain system indexes the cart through the continuous cycle. The oven is electrically heated with temperatures ranging from room temperature to 425°C. Controllers and heaters are placed at various places throughout the unit in order to provide the heat curve desired for the particular size tube being processed. Thus independent and automatic temperature control of each oven section is also achieved.

NEW ULTRASONIC VISCOSIMETER

Ultrasonic Engineering Company, Box 46, Maywood, Illinois, has announced a new ultrasonic viscosimeter which features a rugged, strong, sensitive probe without moving parts. It is said to provide instantaneous, accurate and continuous measurement of viscosity.

Simple and rapid measurements can be made by immersing the sensing element of the probe in any liquid. The instrument panel meter will instantly read directly the solution viscosity in centipoises times density. The device makes possible continuous measurements of solution viscosities from zero to 100,000 centipoises or higher at room or elevated temperatures and will operate even under heavy pressures.



POCKET MEASURE

B. C. Ames Company, Waltham, Mass., has announced application of its Ames No. 25G Pocket Thickness Measure to measure the glass thickness in bottles. The new application is made after two slight modifications in the thickness measure.

The changes are made by reshaping the throat and furnishing a fixed anvil of 1/32″ radius. These modifications allow inspectors to insert the anvil inside the opening of most bottles and then check the glass thickness.

CATALOGS RECEIVED

Wall Colmonoy Corporation, 19345 John R Street, Detroit 3, Michigan, has made available a series of five engineering data sheets for the glass industry. These sheets give information pertaining to the application of Colmonoy nickel-base and iron-base hard facing and Spraywelding alloys that resist abrasion, impact galling and corrosion.

Typical glass industry equipment applications are described in detail, including procedures, part sketches, equipment requirements and results. The data sheets available are: *Data Sheet No. 1.* A table for estimating Colmonoy material requirements. *Data Sheet No. 5.* A table of grinding wheel specifications. *Data Sheet No. 14.* A description of an application of Colmonoy No. 1 alloy to the hard-facing of pulverizer hammers. *Data Sheet No. 34.* Hard-facing applications in the glass container industry, including the Spraywelding of plungers. *Data Sheet No. 36.* Repairing glass container molds with No. 20 alloy, including base metal preparation, preheating of molds, alloy applications and finishing methods.

Pangborn Corporation, Hagerstown, Maryland, has published a condensed Bulletin 1210 featuring the entire line of equipment and accessories offered by the firm.

The well-illustrated, 24-page bulletin has been provided with a special index which simplifies its use. It discusses Rotoblast, Airblast and Hydraulic methods of abrasive application, and pictures and describes the various types of equipment which make use of these three basic principles. All standard units are described, as well as a limited number of the special machines which Pangborn has developed for particular problems.

Solvay Process Division, Allied Chemical & Dye Corporation, 61 Broadway, New York 6, New York, is offering "The Analysis of Alkalies", a new technical and engineering service bulletin.

Solvay reports the scope and arrangement of this fourth edition includes many new and up-to-date additions, and the analytical factors have been recalculated to the basis of the 1952 International Weights. New colorimetric methods for iron and nickel, and procedures for the analysis of caustic soda-sodium nitrite compounds have been included.

Other new additions include: new methods for trace metals, new methods for iron determinations and a new method for determination of sodium nitrite. The new reagents and standard solutions necessary to accomplish the determinations by the new methods have also been added.

General Electric Company, Schenectady 5, New York, has made available a new publication, "Five Steps to Productive Maintenance".

The 18-page bulletin, designated GEA-6087, provides detailed information on organizing to meet the demands that automation will make on an electrical maintenance program. Steps discussed include (1) Gathering equipment date, (2) Determining extent of routine maintenance, (3) Establishing a routine operating control system, (4) Evaluating for critical maintenance and (5) Establishing a critical maintenance program.

Owens-Corning Fiberglas Corporation, General Products Division, Toledo 1, Ohio, has prepared a four-page brochure describing the physical makeup and applications of Fiberglas expansion joint.

The booklet contains complete information concerning expansion joint application on projects involving highways, streets, parking areas and other general construction. Weight tables, widths and thickness are also included in the booklet.

Richardson Scale Company, Van Houten Avenue, Clifton, New Jersey, has issued a new four-page, two-color bulletin featuring control panels for use with weighing and materials handling systems, motor controls, machine tools and plant processes.

The bulletin features 27 typical panels built by Richardson, and numerous control-panel applications. Also included are several photos showing panels being fabricated.

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CURRENT STATISTICS . . .

(*Continued from page* 383)

gross. Compared with the previous month's 9,275,000 gross, a rise of 19.3 per cent is indicated. During May 1953, shipments were 10,753,724 gross, or 2.9 per cent less than for May this year. At the end of the first five months of 1954, glass container manufacturers have shipped a total of 49,900,195 gross. This is only .1 per cent below the 49,996,616 gross shipped during the corresponding period in 1953.

Stocks on hand at the end of May 1954 were 13,745,000 gross. This is 4.9 per cent higher than the 13,099,000 gross on hand at the end of April and 38.7 per cent higher than the 9,909,242 gross on hand at the end of May 1953.

Due to a delay in the compilation of figures showing the production, shipment and stocks of automatic tumbler ware and manufacturers' sales of machine-made table, kitchen and household glassware for May 1954, THE GLASS INDUSTRY is unable to publish these statistics in this issue. It is planned to include these data in this department in the August 1954 issue.

Pressed and Blown Glassware: Value of factory shipments of pressed and blown glassware (except glass containers) reached a new peak in 1953 totaling $371.9 million, 11 per cent above the 324.9 million in the previous peak year of 1952, according to the Bureau of Census. Shipments of lighting glassware in 1953 totaled $146.5 million, an increase of 27 per cent over the $115.8 million shipped in 1952. Shipments of machine-made table, kitchen, art and novelty glassware were valued at $82 million, an increase of 4 per cent over 1952, while shipments of hand-made table, art and novelty glassware showed only a slight increase over 1952. In 1953 shipments of glass cooking ware amounted to $14.8 million. The largest increase in the 1953 value of shipments over 1952 was in electric light bulb blanks, electronic tube blanks and television tube blanks and parts which rose from $87.8 million in 1952 to $115.2 million in 1953.

The data in this report, representing the output of 118 plants, gives shipments from the producing plant or plant warehouse only and do not represent sales of glassware to the ultimate consumer. Glassware shipped on consignment is also included, regardless of whether it was sold by the end of the year. The dollar value of shipments is based on the manufacturer's selling price, f.o.b. plant, exclusive of excise taxes and after discounts and allowances.

L-O-F PROMOTION

Gordon H. Dalton, formerly a floor winder in the continuous fiber glass forming department at the Fiber Glass Division of Libbey-Owens-Ford Glass Company, has been promoted to Foreman on special assignments, it has been announced by D. L. McClure, Plant Manager. Prior to joining L-O-F fiber glass production, Mr. Dalton was employed with the McClure Venetian Blind Company.

Mr. McClure said that Mr. Dalton's advancement from hourly employee to the supervisory staff is in keeping with company policy to train and develop qualified workmen within the organization. He succeeds Richard A. Hawkins, promoted to shift foreman to fill a vacancy.

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RESEARCH DIGEST . . .

(*Continued from page* 381)

at frequencies of 1, 3, 5, 10, 30, 50, 100 and 300 kc for these thirty-five glass compositions were determined and recorded on triaxial diagrams. The following conclusions are based on the experimental results:

(1) In the binary soda-silica and potassia-silica glasses, the dielectric constants and dissipation factors decrease rapidly with decreasing alkali content.

(2) On a weight per cent basis, the potassia-silica glasses have lower values for both dielectric constant and dissipation factor than the equivalent soda-silica glasses.

(3) The dielectric constants and dissipation factors of all glasses studied decrease with increasing frequency in the range from 1-300 kc.

(4) Dissipation factor minima are present in each series of glasses with constant silica content. These minimum values are found at a weight per cent ratio, Na_2O/K_2O, of 1:2. On a molar basis this ratio is 3:4.

(5) Dielectric constant minima were also present for each series of glasses with constant silica content. The locations of the minimum points could not be determined precisely, but they seem to correspond well with the dissipation factor minima.

(6) The dissipation factor values at the minimum points appear to be independent of the total alkali content of the glass.

The following discussion is presented as one possible explanation of the experimental results of this investigation. It is a very simple interpretation and is not intended to be rigorous, nor is it, probably, the only satisfactory one. Additional experimental work in simple glass systems must be completed before a more rigorous interpretation is justified.

According to the generally accepted theories of the constitution of glass, the basic structural elements of silica glasses are SiO_4 tetrahedra, which are randomly oriented and do not possess symmetry. In binary soda-silica and potassia-silica glasses, the alkali ions are assumed to be located at interstices between these tetrahedra. Since the bonding forces holding these ions in place are relatively weak, they have a high degree of mobility, which results in high conductivities and dissipation factors in the glasses.

The experimental results presented here can be explained by the assumption recently advanced by Stevels that a packing effect occurs when both sodium and potassium ions are present in a glass. It is generally accepted that the addition of alkali to a pure silica glass causes some of the oxygen bridges between Si^{4+} ions to be broken. As more alkali is added, more bridges are broken and the glass structure is weakened. It seems reasonable to assume that, as these silica bonds are ruptured, the average size of the interstices in the silica structure is increased. In a glass containing a substantial amount of alkali, it is possible that several ions are located in each large, irregularly shaped interstice. If only one size of ion is present, the packing within each interstice is rather loose and the ions are able to move about with relative ease. As a result of this high degree of mobility, the conductivities and dissipation factors of

(*Continued on page* 390)

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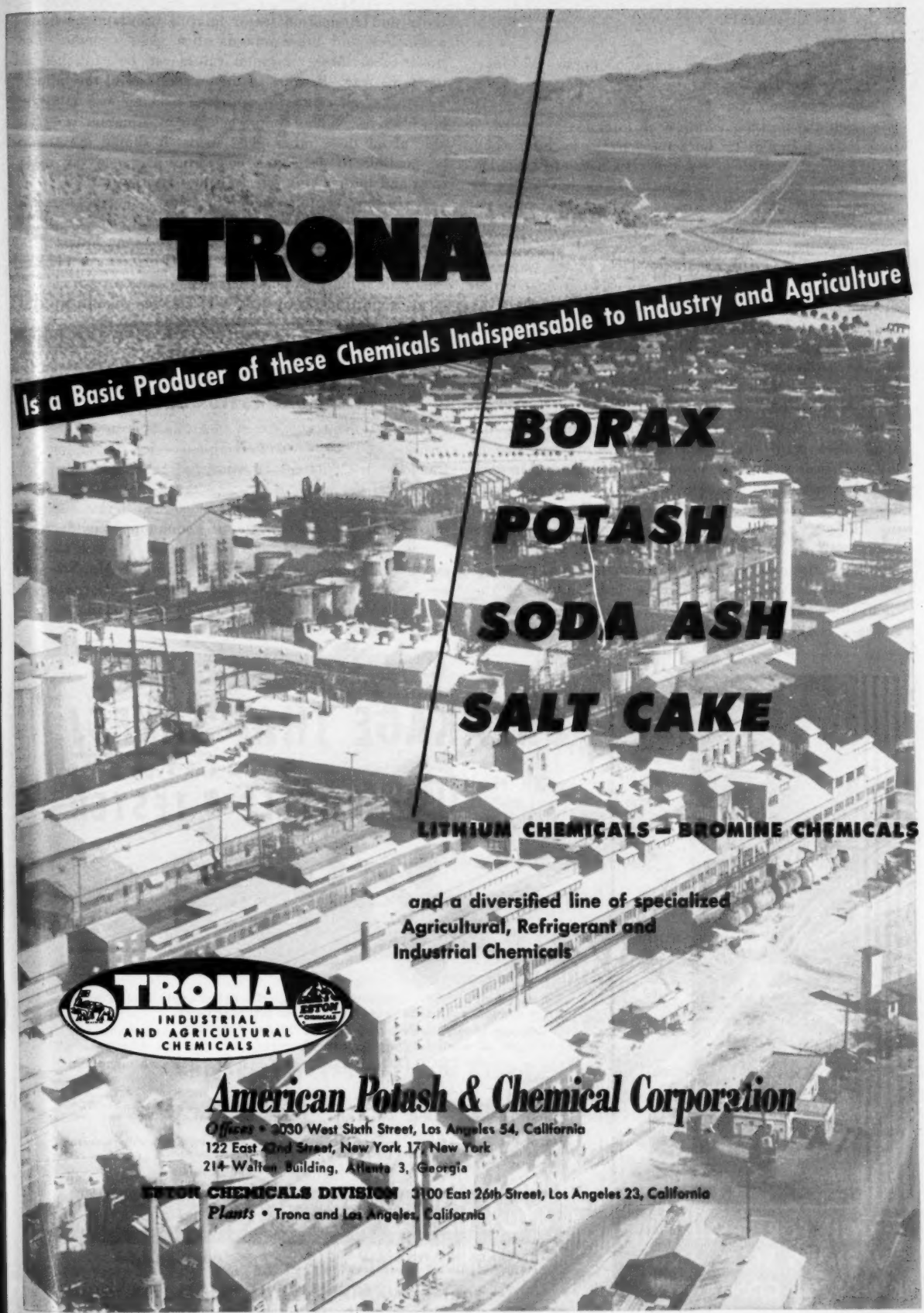
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RESEARCH DIGEST . . .

(*Continued from page* 388)

such glasses are high. This condition applies to binary soda-silica and potassia-silica glasses.

When the alkali content of a glass consists of ions of two sizes, the packing within each interstice is improved in a manner similar to the better particle packing which occurs when particles of two different sizes are available. This tighter packing reduces the ionic mobilities and decreases the ability of the ions to migrate throughout the structure. Such decreased mobility reduces the conductivity and dissipation factor of the glass. When the soda and potassia contents are in the ratio of 0.5, it seems reasonable to assume that the ionic sizes are such that the packing is the most efficient and the ions have the lowest average mobilities.

The efficiency of this packing effect in glasses containing the optimum ratio of soda and potassia is essentially independent of the alkali-silica ratio in the glass, because most of the alkali ions are assumed to be grouped together in relatively large interstices. Increasing the alkali-silica ratio simply increases the average size of the interstices and causes more ions to be packed in each one. As long as a substantial amount of alkali is present and the interstices are quite large, the tightness of packing in each interstice is not appreciably affected. This interpretation is one possible explanation of why the minimum dissipation factor values in the soda-potassia-silica glass system appear to be independent of the alkali-silica ratios.

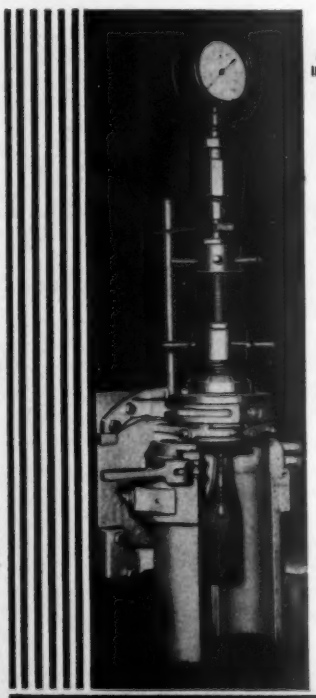
There is substantial evidence to indicate that conductivity and dissipation factor minima occur in the lithia-soda-silica and lithia-potassia-silica glass systems. The presence of these minimum values can be explained in the same way. Because of the smaller size of the lithium ion, the alkali ratios for optimum packing will naturally be different. When comprehensive information is available about these other glass fields, it should eventually be possible to develop a correlation between the ionic sizes and the packing effect at the optimum ratios.

According to this theory, a more efficient packing should occur when ions of three different sizes are present in a glass. If the theory is correct, the lowest possible dissipation factors for alkali glasses should be found in lithia-soda-potassia-silica glasses in which the ideal proportions are maintained between alkali constituents.

BALL BROTHERS NAMES SALES PROMOTION MANAGER

The appointment of Vern C. Schranz to a newly-created position as Sales Promotion Manager for the company's Commercial Container Division has been announced by Sales Manager K. M. Hay.

Mr. Schranz was assigned first to help devise and put into practice a new system of communications for the Commercial Container sales organization. He will also be in charge of advertising and sales training. Mr. Schranz was formerly associated with Studebaker Corporation and earlier had spent eight years in the teaching profession.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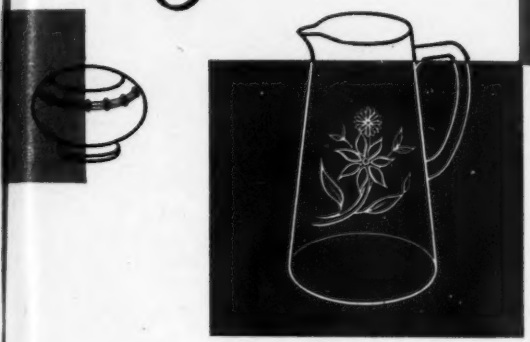

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DU PONT GLASS COLORS

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

SENSITIZING . . .

(*Continued from page* 370)

Zinc Salts. Zinc compounds are mentioned by Banks and Upton in their patent specification, but give no details for its use.

Zirconium Compounds. von Wartenberg recommended the use of zirconium oxide (ZrO_2) in a 0.2 solution as a sensitizer, and later it was referred to by Sharp.

Time Period

The time period of treatment with the sensitizers varies according to the findings of the different investigators. The actual time periods may vary anywhere from a few seconds up to 10 minutes. Some investigators have found that with certain plastics, the time period appears to be a function of the materials under consideration. However, a few preliminary tests by the reader will soon reveal the exact time for the material and thus set the subsequent timing of the balance of the materials. In the case of glass, the treatment is but a minute at most.

Subsequent Washing

After the surface has been sensitized, it is then washed with running water. If this rinsing is not complete, there will result a poorly adherent silver film and, in many cases, a mottled film.

Handling Sensitized Surfaces

Do not touch the surface of the glass or other surface once it is sensitized, because this will leave finger marks and interfere with the proper formation of a silver film on the given surface. If flat glass for mirrors are under consideration, they may be picked up at the edge with blotters free from ink and lint.

Sensitizing Units

A two-compartment unit has been built, the first of which is used to clean the surface. Rinsing is done with water nozzle spray, fitted with foot operated valve. All fittings are corrosion resistant.

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Milestones in Glass Progress

PHOTO COURTESY CORNING MUSEUM OF GLASS

1850 "Witch balls," like this one made in Sandwich, Massachusetts, were said to be used in the homes of superstitious Irish immigrants. They were filled with a long strand of yarn, the end dangling from the blow-pipe hole. Supposedly, witches, wearying of pulling out yarn, left the house. Less superstitious folk used them for decoration.

1890 Michigan Alkali Company, now a division of Wyandotte Chemicals Corporation (South Plant, above), was founded by Captain J. B. Ford to supply Soda Ash to the glass industry. Wyandotte has grown up with glass. Today, as in the past, it is a working partner, supplying technical assistance and raw-material chemicals to those great companies marking milestones in glass progress.

Wyandotte
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Founded by a Glassmaker to Serve the Glass Industry

OBTAINING GLASS SAMPLES . . .
(*Continued from page* 366)

sampling holes were badly drilled and eroded. The brick around one hole which had not been used showed no sign of drilling or erosion. Since it is impossible to withdraw the filled tube without getting some glass on the silica brick, it is not wise to drill a silica crown and take glass samples through these openings early in the campaign.

During the tank repair, special bricks with a 3" hole should be set in the crown to enable one to sample the melting end and center areas of the tank. These special bricks should be zircon which will resist the attack of molten glass.

Since the sampling tubes are fused quartz, there can be no contamination of the glass melt should the tube be broken while it is in the glass. The broken tube will float to the surface and can be fished out or left in the glass to be taken into solution. Even though the tubes are like glass, they are fairly strong and will not break if handled with a reasonable amount of care. It is advisable to have a helper lift the sampling end with tongs as the tube is withdrawn from the tank. This will prevent snapping the filled section of the tube off either inside the tank or outside the tank before the sample can be blown into the mold.

The sample of glass is not contaminated by the sampling tube since it is blown from the tube into a mold. The glass coats the sampling tube as it is pulled in by the vacuum. When the sample is blown from the tube, only the glass in the center is removed, leaving a layer of glass remaining next inserted into the glass, it would be next to the wall of the sampling tube and would not be removed from the tube at the time the sample was blown into the mold.

Production is not affected when samples are taken from either the melting end or refinding end. However, it has been found that, when samples are taken from the forehearths, the tubing lines tend to tighten up and are erratic for a short period of time.

The following is a good example of how this technique has enabled us to gather valuable information and trace an interesting condition which existed in one of our fluorescent tubing tanks supplying glass for two drawing lines. It had been observed during a period when we were drawing cordy and wavy tubing that the daily density checks on tubing from each line consistently had a 10- to 15-point difference between the two lines, indicating that two different glasses were being drawn from the same tank.

This tank was fed with two screw feeders supplied from one bin, and to determine whether batch segregation could cause the condition, the batch being fed into the tank was periodically sampled and checked for segregation during the twelve hours preceding the taking of glass samples. Glass samples were taken from both sides of the melting end—at backwall and bridgewall—and both sides of the refining end. Hourly samples of tubing from each line were also taken during this period and for eighteen hours after the tank was sampled. The density and expansion values for the glass samples show that glass from the east side of the tank had higher density and expansion than glass from the west side and that these differences extended throughout the tank and in the tubing being drawn. This data indicates that there

is very little mixing of the glasses in the melting end or as they pass through the throat on their way to the refining end. Apparently these glasses channel straight down the sides of the melting end, through the throat and refining end, to the forehearths supplying glass for each drawing operation.

The check for batch segregation showed that the east feeder was feeding a higher cullet ratio and a higher acid soluble batch than the west feeder. Since it appears that there is very little mixing of glass in the melting end, it is essential that a uniform batch be fed into the tank by all feeders at all times if one expects to obtain top quality tubing. Steps have been taken to eliminate the segregated batch condition, and now very little differences in the glass densities from side to side across the tank or in the line densities are found.

INTERNATIONAL SYMPOSIUM TO BE HELD

An International Symposium will be held in Paris in June 1955 by the Union Scientifique Continentale du Verre. This meeting will be open to all scientists and technologists who are interested in glass.

The general subject of this symposium is The Fining of Glass. The program will be announced at a later date.

PITTED WINDSHIELD RESEARCH

Pitted automobile windshields are the result of normal wear, according to the view taken by scientists who have been studying recent cases of "pock-marked" windshields in the Chicago area.

Talk about H-bomb effects merely has made people more observant about marks on their windshields, explained John Krc, Jr., research crystallographer, and Dr. Walter C. McCrone, senior chemist, both of Armour Research Foundation of Illinois Institute of Technology.

The scientists based their observations on the examination of approximately 25 samples of shattered and pitted windshields submitted for analysis by Chicago area motorists. "We found the marks in nearly every case to be similar and several months old," Mr. Krc said. "There was no evidence that the damage was the result of radioactivity, cosmic rays, air rifles or other such causes." Gravel, dirt or stones accounted for every particle scraped from the holes, they said. Dr. McCrone and Mr. Krc do not believe new curved front windshields are more susceptible to flying gravel than older types. "But when a curved rear window is hit, it may disintegrate more completely than a flat window," Dr. McCrone said.

The "mysterious" honeycombing of some of the glass samples apparently was caused by the same thing that produced pitting—stones thrown up by cars—according to the examinations. Rear windows showed honeycombing, while front windows were pitted, the scientists explained.

Rear windows are usually made of tempered glass purposely strained in construction to give structural strength. When the surface is broken, they said, the strain is released and the window disintegrates into a cobweb pattern. Front windows, however, are laminated with plastic as a safety feature to prevent this. When these are hit, the glass is likely to show pits rather than honeycombing, they added.

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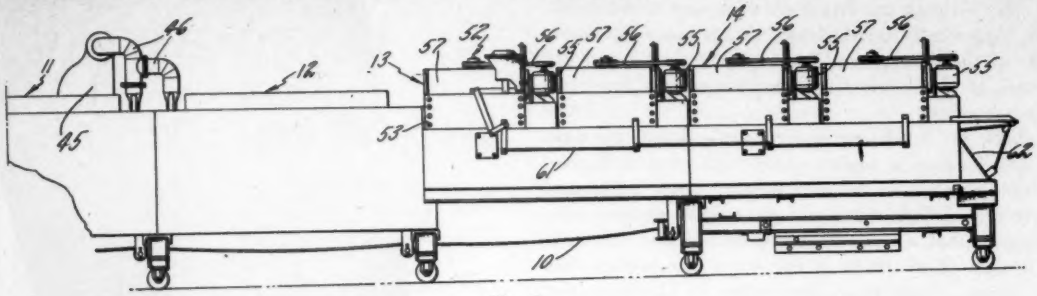


Fig. 8.

zone is a muffled cooling zone of the tunnel which is provided by lehr sections 11 and 12. This zone cools the ware at a somewhat faster rate than the annealing zone and prepares the ware so that it may enter, without breakage from heat shock, a forced cooling zone which is provided by lehr sections 13 and 14. Thus, the muffled cooling zone acts as a buffer between the slow cooling or annealing zone and the forced cooling zone where the ware is cooled to handling temperatures. Fans in each of the sections 13 and 14 supply cooling air by means of which the necessary cooling is effected in the forced cooling zone, and, in addition, longitudinal air drift is established in the tunnel T to maintain desired temperature conditions throughout its length.

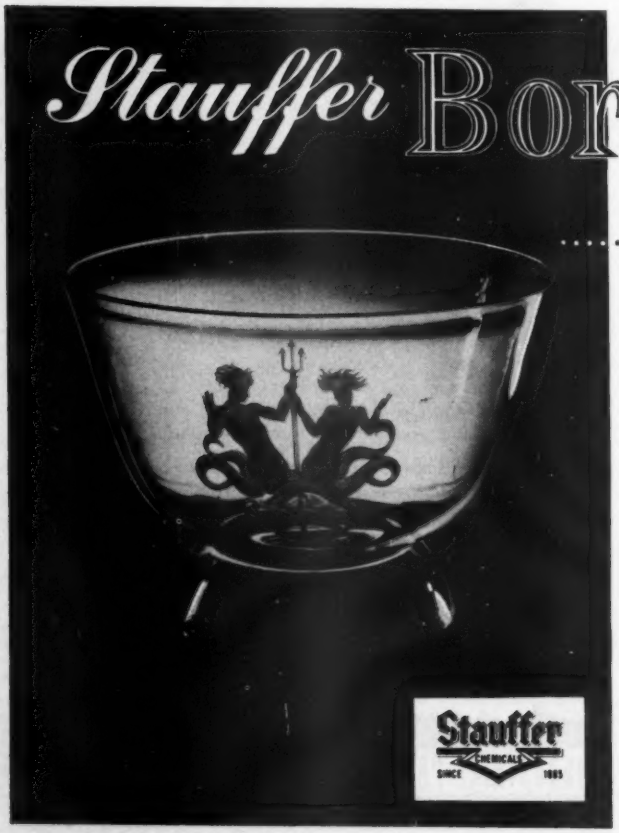
The several cooling zones of the lehr are each formed by the individual sections and may be readily altered to satisfy the requirements of different ware types and weights. One or more sections may be inserted or removed from each of the zones thereby giving the lehr versatility.

The patent contains six claims and the references cited were as follows: 1,670,769, Hiller, May 22, 1928; 1,783,208, Williams, Dec. 2, 1930; 2,275,263, Merrill, Mar. 3, 1942; and 2,507,673, Merrill, May 16, 1950.

McKEE CUTS ASH TRAY PRICE

The McKee Glass Division, Thatcher Glass Manufacturing Company, has announced an across-the-board reduction in prices on their "Fires-out" ash trays.

Available in two sizes—4¾" and 6" diameter—the ash trays were previously sold to retail at 25¢ for the smaller and 39¢ for the larger. At the new prices announced by McKee, they will sell for 15¢ and 25¢.



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N.L.R.B. DECISION FAVORS G.B.B.A

An important N. L. R. B. decision in favor of the A.F.L. Glass Bottle Blowers Association has been announced by Lee W. Minton, President of the G.B.B.A. The National Labor Relations Board unanimously ruled against the Glass, Ceramic and Silica Sand Workers Union, C.I.O., in their attempt to carve out a production unit in the Owens-Illinois Glass Company plant, organized by the A.F.L. union, at Streator, Illinois.

Local 140 of G.B.B.A. has represented the employees at the Streator plant since 1952 as a result of a decisive election victory. Following the election, the Streator unit was included in multi-plant negotiations covering ten plants of the Eastern Division of Owens-Illinois.

The N.L.R.B. decided the multi-plant negotiations were in the best interests of both employees and employer and therefore disallowed the petition of the C.I.O. for another election. The N.L.R.B. pointed out in its decision that in the 1952 election in which the employees chose the G.B.B.A, the arguments advanced by the A.F.L. union emphasized the fact that victory for G.B.B.A would mean company-wide bargaining for the Streator plant jointly with the employees of the other nine Owens-Illinois plants in the Eastern Division.

• Alfred Iddles, President of the Babcock & Wilcox Company, has accepted the chairmanship of the Industrial Equipment Division in this year's campaign to raise $950,000 for the public service program of the National Safety Council, it has been announced by W. S. S. Rodgers, Chairman of the Council's trustees.

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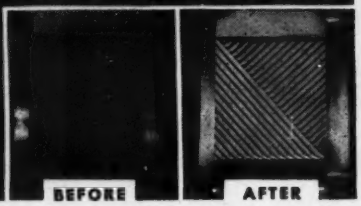

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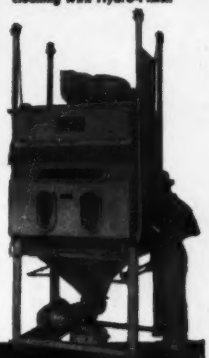

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INDEX TO ADVERTISERS

	Page
Aluminum Company of America	393
American Potash & Chemical Corp.	389
Calumite Company, The	386
Carborundum Company, The	358
Classified Advertising	398
Corhart Refractories Company	351
Diamond Alkali Company	360
Drakenfeld & Co., Inc., B. F.	355
du Pont de Nemours & Co., Inc., E. I.	391
Dustex Corporation	398
Eisler Engineering Company	398
Exact Weight Scale Company	400
Forter-Teichmann Company	399
Frazier-Simplex, Inc.	349
Harbison-Walker Refractories Company	361
Harshaw Chemical Company, The	357
Kahle Engineering Company	398
Kaiser Aluminum and Chemical Company	363
Kirk & Blum Manufacturing Company	Cover II
Laclede-Christy Company	364
Lynch Corporation	354
National Gypsum Company	395
Overmyer Mould Company	362
Pacific Coast Borax Company	353
Palmer & Associates, Delos M.	399
Pangborn Corp.	399
Pemco Corporation	387
Remmey Son Company, Richard C.	388
Sharp-Schurtz Company	399
Solvay Process Div., Allied Chemical & Dye Corp.	359
Stauffer Chemical Company	396
Surface Combustion Corp.	Cover IV
Taylor Sons Company, Chas.	Cover III
Toledo Engineering Company	390
Vitro Manufacturing Company	247
Walsh Refractories Corp.	352
Westvaco Chemical Div., Food Machinery & Chemical Corp.	385
White Dental Mfg. Co., S.S., Industrial Div.	356
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp.	399
Wyandotte Chemicals Corp.	394

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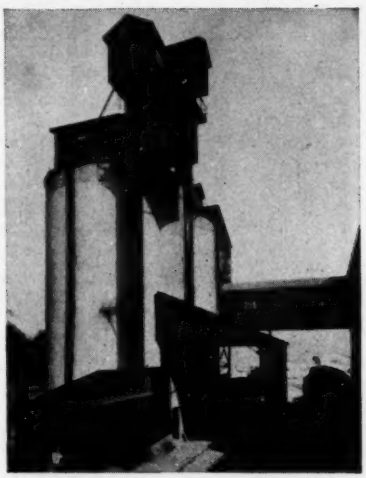

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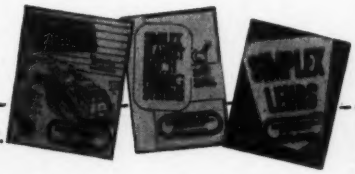

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CONTENTS FOR AUGUST : 1954

The Annealing of Flat Glass 423
A translation by Kate Gay Eells and Neill M. Brandt of the second part of an article appearing in *Verre et Refractaires.* A translation of Part I appeared in the February 1952 issue of THE GLASS INDUSTRY. By Boris Daragan.

Scandinavian Glass Society Host to International Commission 430
A report of the meeting of the International Commission on Glass, an outline of plant visits and abstracts of papers delivered.

Galvanic Potentials in Silicate Melts 433
The first of a series of Information Circulars of the Institute of Silicate Research, University of Toledo.

Inventions and Inventors 437
A summary of recently issued patents of interest to the glass industry.

Research Digest 441
A digest of a paper, "Some Mechanical Problems of Glass Pressers". Various phases of the processes and problems of pressed ware are covered in this summary.

Current Statistical Position of Glass 444
Production, shipments and employment in the glass industry during May and June 1954.

New Equipment and Supplies 448

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